Electrical Construction and Maintenance

WITH ELECTRICAL CONTRACTING

APRIL • 1958
PRICE 40 CENTS

NEW ORLEANS MOTOR SHOPS,

1958 NISA Convention hosts, use modern equipment and methods to serve a growing market.

page 57

SAN FRANCISCO OFFICE BUILDING

electrical system includes prize winning lighting, motor-control centers and hi-fi sound system.

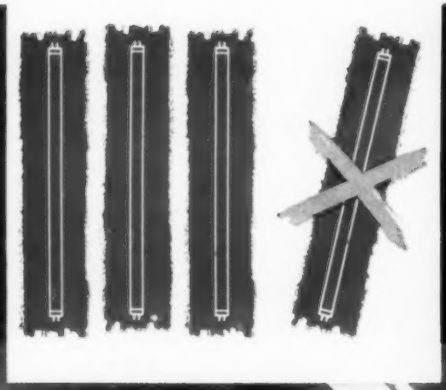
page 82

Wiring for Air Conditioning –

analyzing approved practice in the installation and protection of circuits and components.

page 65

A McGRAW-HILL PUBLICATION | 57TH YEAR



three lamps do more than four with Prismoid

Engineer: John D. Severance,
Iowa-Illinois Gas & Elect. Co.
Rock Island, Ill.
Contractor: L & W Elec. Co., Rock Island, Ill.
Wholesaler: B & M Elec. Dist. Co., Rock Island, Ill.

GUTH PEERLITES® WITH PRISMOID GRATELITE* LOUVERS AT McCABE'S, ROCK ISLAND, ILL.

Originally, this job was laid out for 50 footcandles with Brand X fixtures (4 lamp—75 watt).
But McCabe bought Guth Peerlites with Prismoid Louvers, using only *three* 75-watt lamps.
Result: 100% more light than with the 4-lighters!
And more! The crystal beauty and cheerful atmosphere created by Prismoid flatters the merchandise and puts shoppers in a buying mood.

100 FOOTCANDLES WITH ONLY 2.5 WATTS PER SQUARE FOOT—THAT'S EFFICIENCY!

Get the complete story of Prismoid efficiency, beauty and breathing action—write us on your letterhead today!

PRISMOID GRATELITE

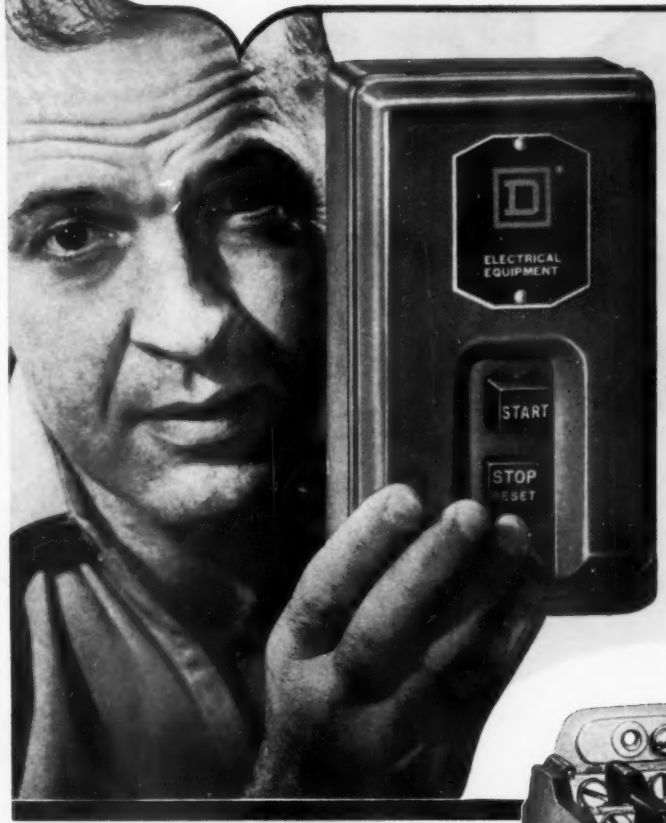
Guth

THE EDWIN F. GUTH COMPANY
ST. LOUIS 3, MO.

TRUSTED NAME IN LIGHTING SINCE 1902

*T. M. Reg. U.S. & Can. Pats. Pend.

This NEW Manual Starter has EVERYTHING!



NEMA Sizes 0 and 1

Two, three and four-pole construction

SMALLER! **Takes less space, whether it's built into machine or mounted externally**

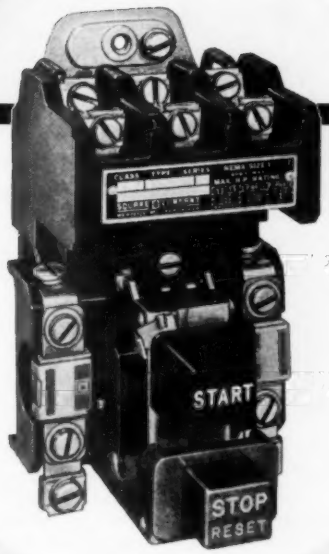
SMART STYLING! **Matches the streamlined appearance of today's modern machines**

QWIK-MAKE, QWIK-BREAK! **Positive snap-action opening and closing of contacts. Longer contact life**

TRIP-FREE OVERLOAD PROTECTION! **Impossible for operator to hold motor circuit closed against overload**

LONGER LIFE! ***Toggle Action*** **operating mechanism. Heavy-duty construction throughout**

EASIER INSTALLATION! **Wire it without removing starter from enclosure. All terminals have pressure wire connectors**



EASIER MAINTENANCE!
"Off-the-Shelf" parts kits make normal maintenance and modifications easier than ever. They're easy to buy, easy to identify, and faster to install

TAMPER-PROOF!
Cover padlocking device prevents tampering by unauthorized personnel. Safety latch locks "start" button in "OFF" position

VISIBLE INDICATION OF OVERLOAD!
Self-centering push-buttons show when overload has occurred

CHOICE OF ENCLOSURES:

Water and Dust-Tight
Hazardous Locations
Flush Mounting

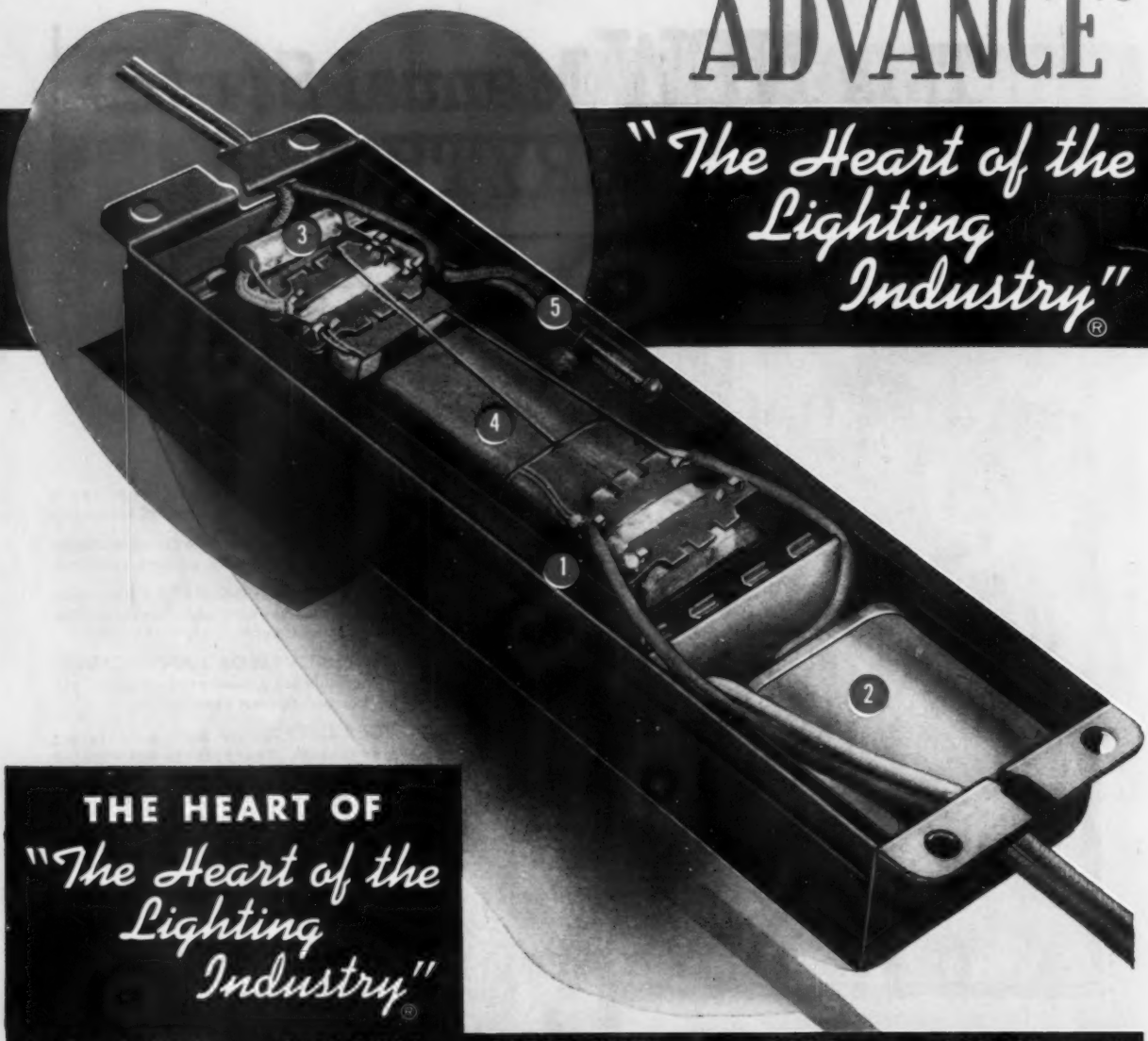
Write **for BULLETIN 2510 B-C**
Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

ADVANCE®

"The Heart of the Lighting Industry"®



THE HEART OF "The Heart of the Lighting Industry"®

SHELL & CORE

1 Constructed of high-grade silicon steel, punched to exacting tolerances and precision assembled. Core and shell are annealed to insure lowest wattage losses.

CAPACITOR

2 Capacitors for Power Factor correction and phase displacement are of highest quality construction. Rigid inspection and factory testing assure uninterrupted, dependable service.

RADIO FILTER

3 Built-in filter corrects line feed back to the radio from the lamp through the power line and prevents direct radiation from the electric supply line to the aerial circuit.

COILS

4 Coils are firmly wound and are of identical size, shape, weight and operating characteristics. The complete assembly is vacuum impregnated with a thermal setting phenolic varnish.

ADVAN-guard

5 A thermally actuated protective device that prevents ballast operation at abnormal temperatures thus increasing fluorescent lamp ballast life. Advanguard optional at additional cost.

ADVANCE®

CBM CERTIFIED

World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

TRANSFORMER CO.

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

Electrical Construction and Maintenance

with which is consolidated Electrical Contracting, The Electragist and Electrical Record . . . Established 1901

Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

57TH YEAR APRIL • 1958

Washington Report 7

Sidelights 9

Lighting Break-Through, *An Editorial* 55

Motor Shops in New Orleans 57

Host to the 1958 convention of the National Industrial Service Assn., New Orleans boasts a dynamic motor shop industry serving a large, widespread market of commercial, industrial and marine electrical systems.

Air Conditioning Wiring and the NEC 65

By W. J. NOVAK—An up-to-the-minute analysis of current practices in the wiring and protection of circuits and components used with today's air conditioning equipment.

Synchronized Conveyors 78

By G. E. MATHIAS—Automotive assembly plant uses 7½ miles of synchronized conveyors and many new developments in electrical control to obtain high degree of automation for mass production.

Designed for Efficiency, Convenience and Comfort 82

San Francisco office building designed for efficiency, convenience and comfort combines modern electrical system with complete air conditioning, hi-fi PA system and earthquake resistance construction.

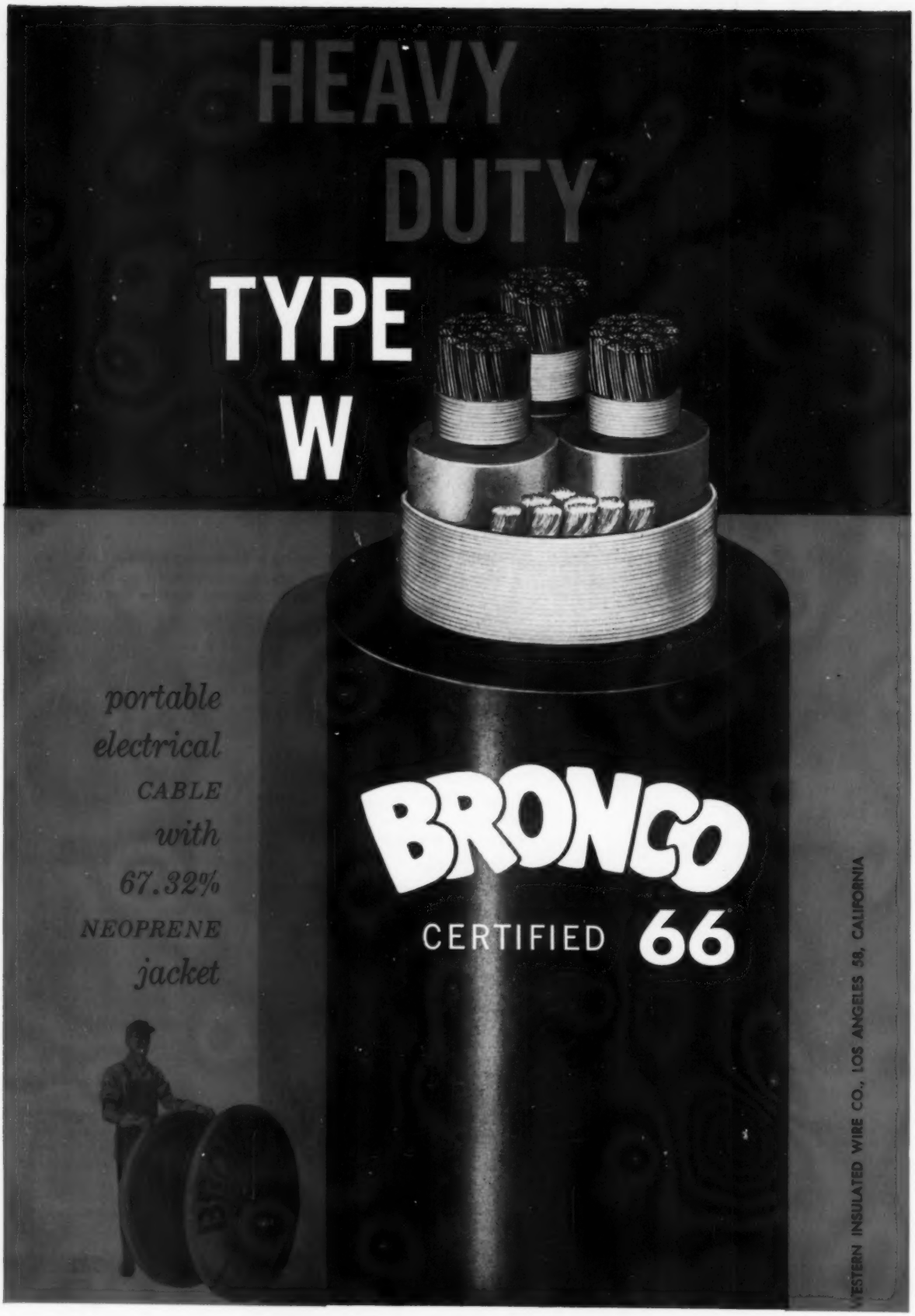
Estimating Forum-X 89

By RAY ASHLEY—Operating costs—low overhead markup on large contracts.

Load-Center Layout in a Shopping Center 90

By JOHN OWNBY—Design and construction details of a modern, high capacity electrical system carefully matched to load requirements in the new Meyerland Plaza, a shopping center in Houston, Texas.

MORE


HEAVY
DUTY
TYPE
W
portable
electrical
CABLE
with
67.32%
NEOPRENE
jacket
BRONCO
CERTIFIED 66
WESTERN INSULATED WIRE CO., LOS ANGELES 58, CALIFORNIA

Electrical Construction and Maintenance

W. T. STUART, *Editor*

Alice McMullen, *Managing Editor*

Berlon C. Cooper, *Eastern Editor*

August Eckel, *Middle West Editor*

Hugh P. Scott, *Industrial Editor*

J. F. McPartland, Jr., *Engineering Editor*

W. J. Novak, *Assistant Editor*

W. J. Martens, *Assistant Editor*

L. E. Devendorf, *Art Editor*

Ray Ashley, B. A. McDonald, Glenn Rowell, B. Z. Segall, *Consulting Editors*

W. A. Cyr, *Western Consultant*

Dexter Keezer, *Dir. Economic Staff*

George B. Bryant, Jr., *Chief Correspondent, Washington Bureau*

John Wilhelm, *Editor, World News*

W. W. GAREY, *Publisher*

A. L. DeWeerdt, *Circulation Manager*

C. B. Shaw, *Advertising Sales Manager*

District Managers

A. B. Conklin, *New York*

E. P. Gardner, *New York*

A. E. French, Jr., *Philadelphia*

F. J. Seiler, *Cleveland*

R. A. Hubley, *Detroit*

Charles F. Minor, Jr., *Chicago*

R. R. Ream, *Chicago*

T. H. Carmody, R. C. Alcorn, *San Francisco*

George Miller, *Dallas*

R. H. Antles, *Los Angeles*

R. H. Powell, *Atlanta*

Member of
AUDIT BUREAU OF CIRCULATIONS and
ASSOCIATED BUSINESS PUBLICATIONS

APRIL • 1958 *continued*

New Lamp and Luminaire Design **96**

Ground-up analysis resulted in new lamp and luminaire design to floodlight 7-million sq-ft terminal plaza at International Airport.

Practical Methods **187**

Printed form speeds panel installation; storage rack for active blueprints; low-voltage switching provides trucking pick-up control.

Motor Shops **199**

Hydraulic-screw press exerts 10-25-ton thrust; color-coded tags indicate motor status; auxiliary ducts raise oven temperatures.

Reader Service **203**

Product news announcements; catalogs and bulletins.

Reader's Quiz **239**

Questions and answers on removing cable from conduit; two motors on the same load; brush chatter; testing an induction motor; insulation-resistance measurements.

Questions on the Code **247**

Answers to code questions on underground distribution system; sealing conduits—service station; automatic sprinkler system; motor disconnecting means; wiring for a farm house.

In the News **267**

Dates Ahead **286**

Vol. 57, No. 4 ELECTRICAL CONSTRUCTION and MAINTENANCE April 1958

Published monthly with an additional issue in September by McGraw-Hill Publishing Company, Inc. James H. McGraw (1860-1948), Founder. Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Director of Advertising Sales; A. R. Venezian, Vice-President and Circulation Coordinator.

Subscriptions are solicited only from persons engaged in electrical construction, maintenance or consulting services. **Position and company connection must be indicated on subscription orders.**

United States subscription rate for individuals in the field of the publication $3.00 per year. This issue 40 cents. Electrical Products Guide $2.50. Canada, $5.00 a year. All other countries, $15.00 a year, payable in advance. Entered as second class matter August 29, 1938 at the Post Office at Albany, N. Y., under act of Mar. 3, 1879. Printed in U. S. A.

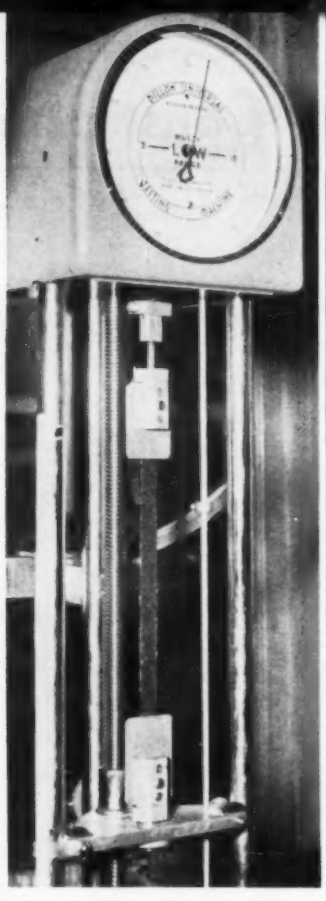
©Copyrighted 1958 by McGraw-Hill Publishing Co., Inc. — All Rights Reserved.

SUBSCRIPTIONS: Send subscription correspondence and change of address to Subscription Manager, Electrical Construction and Maintenance, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Subscription Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Test-Proven for Superiority . . .

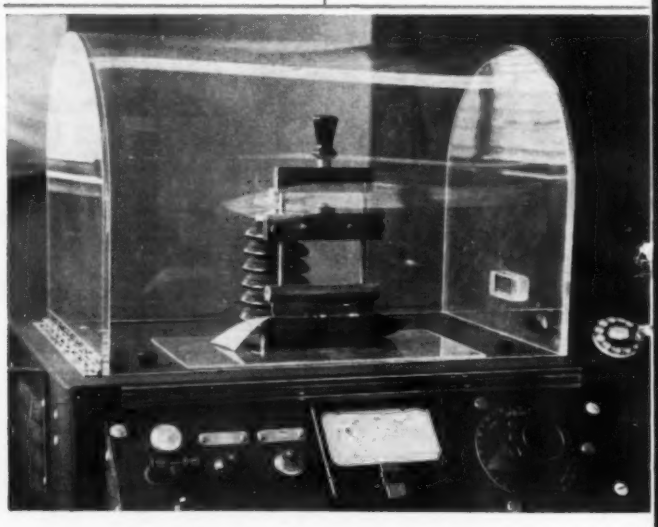
ACCURATE TAPES

Friction, Rubber, and Plastic



TENSILE

ADHESION



DIELECTRIC

Send today for our most recent bulletin describing details.

ACCURATE

MANUFACTURING COMPANY
GARFIELD, NEW JERSEY

Washington Report

● **The recession has dwarfed all other national issues** for the past couple of months, with both Congress and the Administration proposing a variety of remedies. Government economists, after admitting the recession had deepened further than was expected, now predict the economy will level out through the summer and begin a gradual upturn this fall.

Principal indicators which serve as a measure of the depth of the economic downturn include:

Unemployment—which expanded by two million from mid-December, at 3.4 million to mid-March, at 5.4 million. Normal unemployment averages about 2.5 million, so today's unemployment contributing to the recession is roughly three million, mostly unskilled and semi-skilled workers.

Industrial Production—has dropped 10% in six months, and 11½% from its peak. FRB Index for August 1957 was 145, which slid to 130 in February this year. Record of 147 was reached in December 1956. Durable goods declined 18%, non-durables only 5%. Steel production in February was 53.6% of capacity; auto production in March was 38% below a year earlier, in February down 31%, and in January down 24%.

Personal Income—was down to $341.8 billion annually in February, from record of $347.5 billion annually last August—a drop of 1.64% in six months. Unemployment was the major factor in this decline.

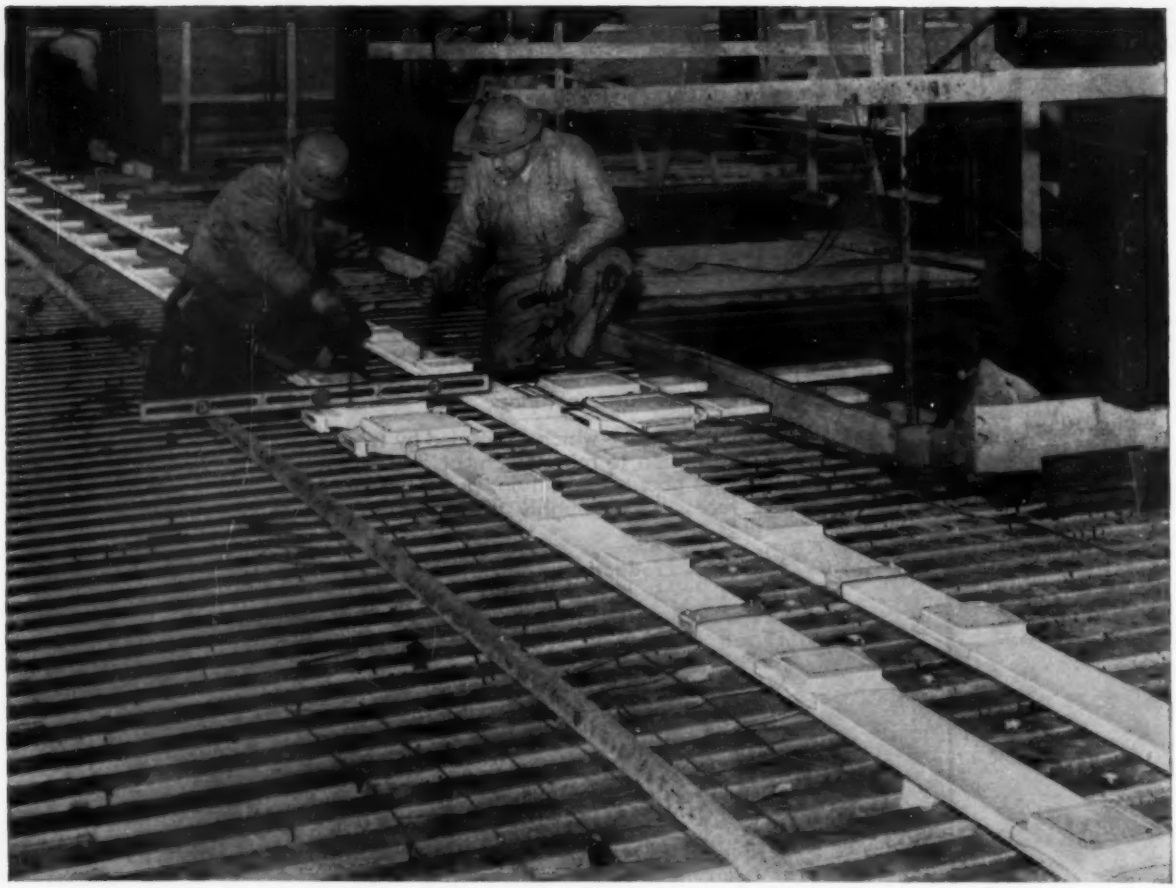
● **Some anti-recession actions have been taken,** and many proposals have been made and are under study. But the Administration refuses to be "panicked" into quick action on the myriad pet Government projects being promoted and pushed as recession cures. Administration policy was defined in part by President Eisenhower's assurance in mid-March that the real mainspring of the economy is not Government but private enterprise; and by Vice President Nixon's statement that "What I believe the economy needs at this time is more spending by individuals and business rather than more spending by Government".

Actions taken designed to curb the recession include:

—Speeding up of authorized spending for defense, and proposal to increase original $39.1 billion defense request for fiscal 1959 by $1.5 to $2.0 billion.
—Directing that public works now approved be speeded up.
—Proposal that states consider Federal aid to help them meet and broaden unemployment insurance.
—Proposal that highway spending be increased.
—Making more funds available for the home mortgage market.
—Readying of a detailed program calling for cuts in personal, business and excise taxes (to be submitted only if the recession continues to deepen). The Committee for Economic Development recommended that a cut of 20% be made if the decline holds through April.

Both the Administration and Congress have been holding off on drastic anti-recession measures (many pet schemes have been proposed and discussed) until the signs are clearer.

● **Other economic highlights:** Cost-of-living index inched up to 122.5% (of 1947-49 average) in February, highest on record; housing starts dropped to 65,000 in February, down from 69,000 in January (attributed in part to bad weather); retail sales declined to $16.2 billion in February, down 3% from January, and 1% from a year earlier; capital expenditures for plant and equipment are dropping much faster than had been expected—new estimate is $32 billion total for this year compared with $37.6 billion last year.



New Spang Headerduct for use with cellular floor construction is quickly and accurately aligned in preparation for pouring concrete.

SPANG Headerduct Systems give you these 4 advantages

1. Advanced design

This newest headerduct, the largest on the market, incorporates all the latest time-saving features to help you make fast, low-cost cellular floor electrical installations!

2. Square access units

—provide you with maximum working area to make wiring connections. Corner leveling screws provide fast, accurate adjustments to bring headerduct to screed level.

3. Safety-coat finish

Bright yellow paint finish inside and outside gives maximum visibility, helps prevent construction site accidents and facilitates wire pulling.

4. Top-quality fittings

A complete line, in newest designs, for every need . . . available in brushed aluminum or brass finish. Neoprene gasket provides positive seal.

Write for complete information

A new Spang Headerduct Catalog and a "How-to-Install" booklet are yours for the asking. Write today for your free copies.

Spang also produces Standard Duct and Industrial Duct for use with conventional slab construction in both commercial and industrial buildings. Literature on these products is also available.

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Office: 2 Gateway Center, Pittsburgh 30, Penna.
District Offices and Sales Representatives in Principal Cities

Sidelights

MOTOR SHOPS

Next month the National Industrial Service Association will hold its 1958 convention in New Orleans, La. The area is served by a dynamic motor shop industry with an active market in commercial, industrial and marine electrical systems and equipment. Many of the shops will hold "open house" for the visitors. Engineering Editor J. F. McPartland took an advance swing around the shops, rounding up the points of particular interest to brief readers on what to look for. See "Motor Shops in New Orleans", beginning on page 57.

WIRING FOR AIR CONDITIONING

The rapid growth in demand for all types of air conditioning equipment is creating a great many electrical jobs involving complex hook-ups of motors and controls. Manufacturers' instructions are often hazy or inadequate. Code requirements are complicated and exacting. Assistant Editor W. J. Novak decided to tackle this difficult subject some months ago and to bring together an authoritative analyses of current approved practice in the wiring and protection of circuits and components used with today's air conditioning equipment. The results of this study are presented in this issue in what we believe is the most comprehensive treatment of this important subject available. "Air Conditioning Wiring and the National Electrical Code" begins on page 65.

CONVEYOR SYNCHRONIZING

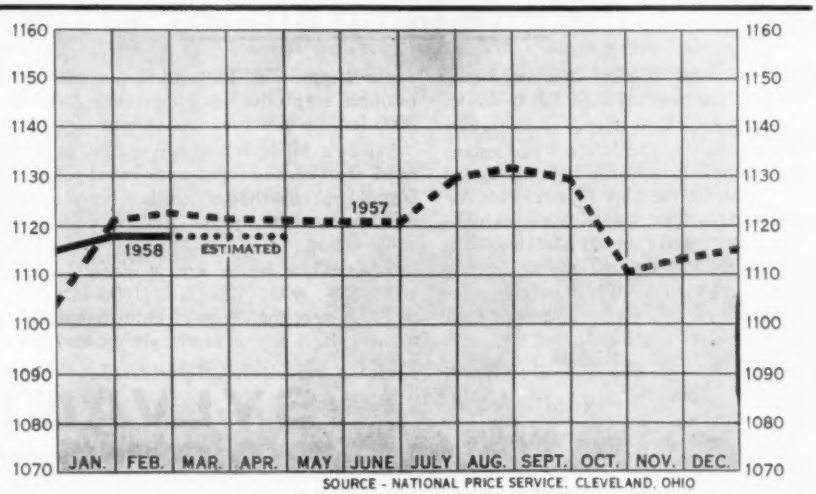
To achieve the degree of automatic operation necessary for modern mass productions requires a very accurate control of the conveyor system which moves the work through the plant. An automotive assembly plant with 7½ miles of synchronized conveyors involving many new developments in electrical control is described by G. E. Mathias, of the System Control Department of Westinghouse, in "Synchronized Conveyors" beginning on page 78.

INSURANCE BUILDING

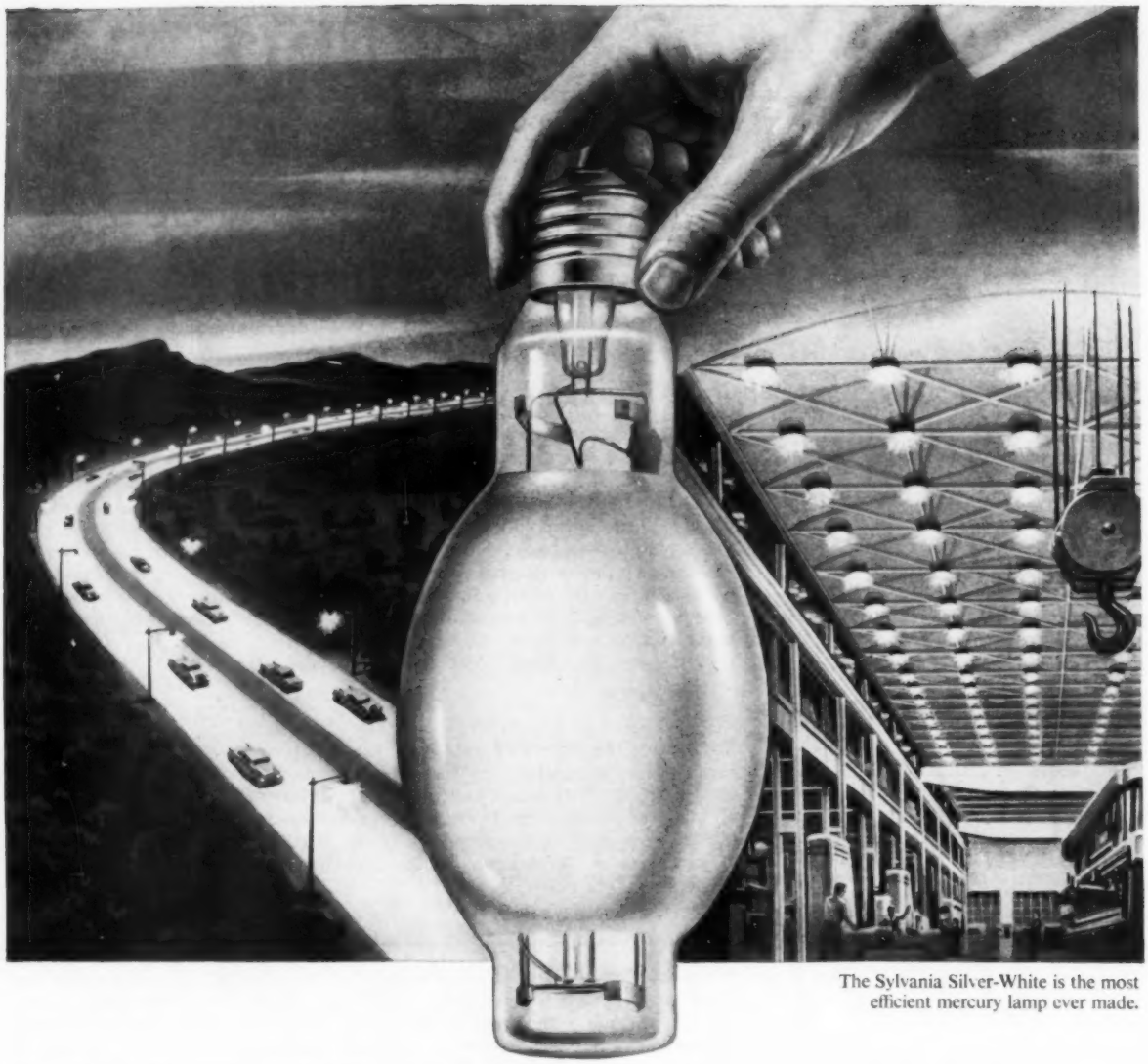
The new headquarters of the Fireman's Fund Insurance Company in San Francisco includes a prize winning lighting system, motor control centers, five substations with drawout switchgear and 12 kv underground primary service. The modern electrical system, including a hi-fi PA system is described by H. P. Scott in "Designed for Efficiency Convenience and Comfort" beginning on page 82.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO



The Sylvania Silver-White is the most efficient mercury lamp ever made.

For highway . . . or high-bay

. . . the one-lamp answer to both lighting needs

Today's most efficient mercury-vapor lamp is the new Sylvania Silver-White.

The greater light output and superior color quality of the Silver-White makes it an effective, versatile lighting source . . . it serves the high requirements for such widely different applications as highway lighting and high-bay plant illumination with unequalled efficiency.

Sylvania's Silver-White actually delivers up to 33% more lumens of light than previous color-improved mercury-vapor lamps. The 100-watt lamps, for example, are producing an unprecedented 4000 lumens in actual installations.

Sylvania Silver-White lamps cost no more than conventional color-improved lamps—but offer the combined economies of superior light output and superior construction.

Silver-White lamps are available in 100-, 175-, 400-, 700-, and 1000-watt types to meet the needs of industry for efficient high-bay indoor lighting and outdoor illumination for parking and loading areas . . . and for the governmental requirements for effective highway lighting.

For complete information about the Sylvania Silver-White Mercury Vapor lamp, call your local representative, or write:

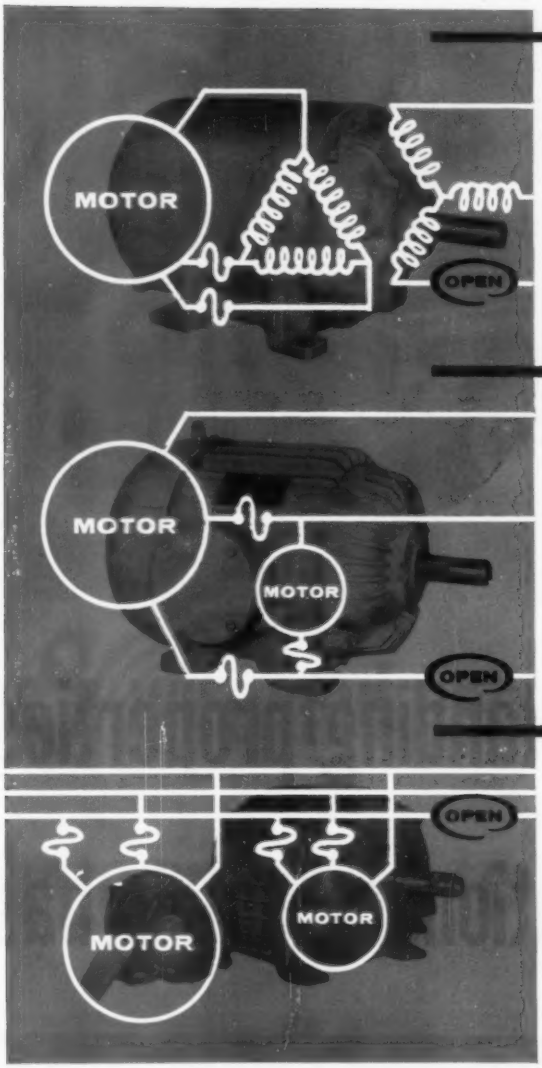
SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Dept. 8L-8304
60 Boston St., Salem, Mass.
In Canada: Sylvania Electric (Canada) Ltd.
Shell Tower Building, Montreal

SYLVANIA

. . . the fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

Three-Coil Overload Protection Would Have Prevented These Motor Burn-outs

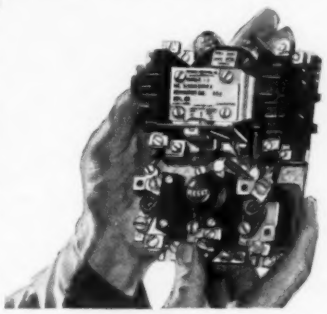


MOTOR No. 1. Even though this three-phase motor was equipped with a 2-coil overload relay, the motor burned out . . . and here's why. Like the vast majority of three-phase motors in use today, this motor took its power from a wye-delta transformer; and an open phase condition in the transformer primary caused one high and two low motor currents. The 2-coil overload relay could not save this motor because the high current was in the unprotected line. When you wire three-phase motors be sure they are equipped with 3-coil overload relays . . .the only dependable overload protection for all open phase conditions.

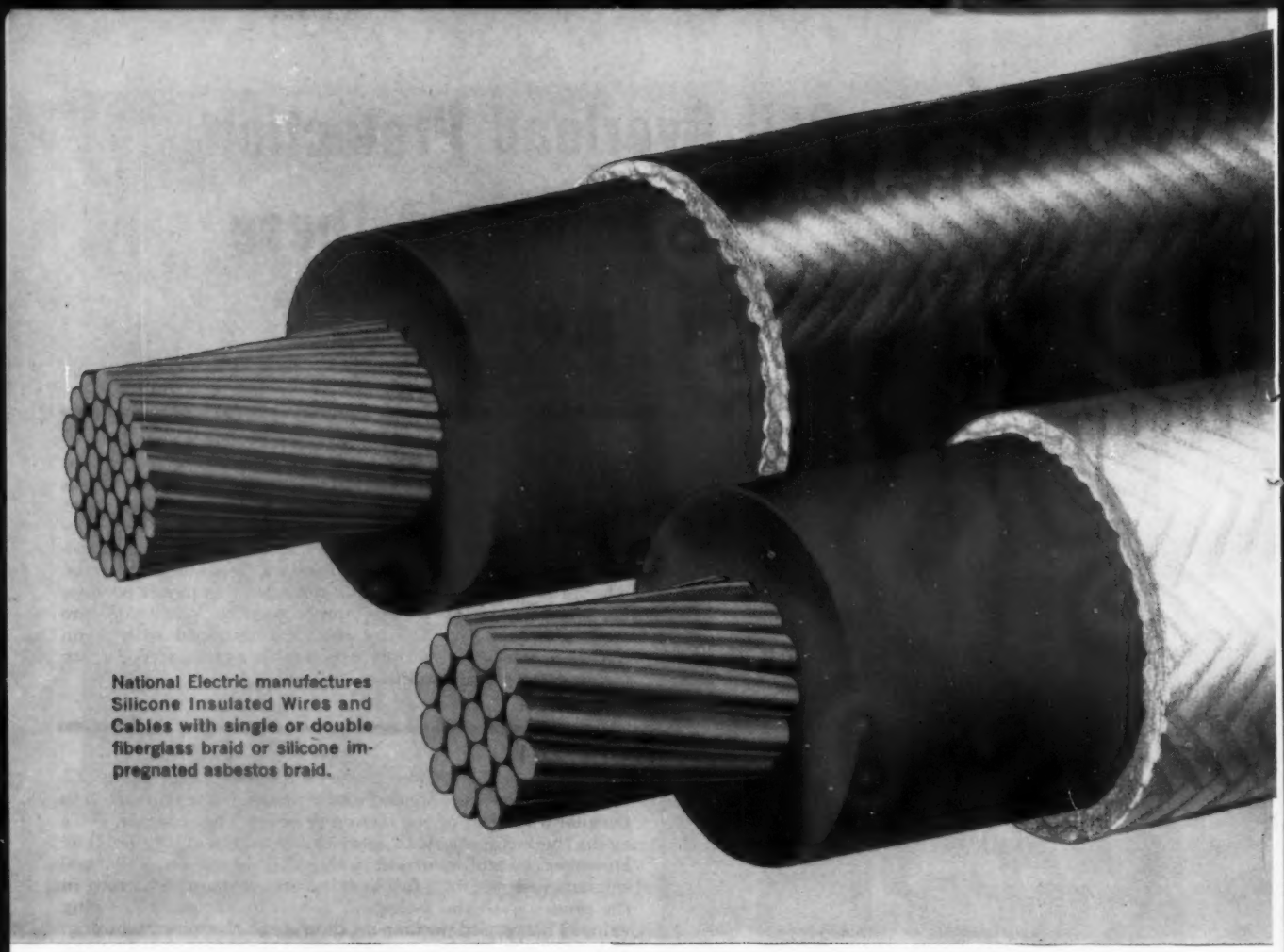
MOTOR No. 2. This three-phase motor was operating at 70% full load with a 40% loaded single phase motor connected in parallel when one of the incoming power lines opened. Once again the 2-coil overload relay failed to detect any trouble. However the motor current in the winding without a thermal element rose to 152% full load current, while the current in the phases with the 2-element relay did not reach tripping value. This caused permanent damage to the motor winding. This motor could have been saved with full three-phase overload protection. Be sure the three-phase motors you wire are completely protected from the hazards of all open phase conditions with dependable 3-coil overload relays.

MOTOR No. 3. This 1 Hp, three-phase motor was working in parallel with a 10 Hp, three-phase motor when one of the incoming power lines opened. While the 10 Hp motor was not adversely affected by this circuit unbalance, the motor current in one line of the 1 Hp motor reached 140% full load current resulting in a burned out winding. As in the other examples, the 1 Hp motor's 2-coil overload relay proved ineffective because the overload occurred in the one line left unprotected. Don't let this happen to your customer's motors. Install 3-coil overload relays on all three-phase motors, large or small . . . only 3-coil overload relays provide dependable open phase protection under all operating conditions.

Cutler-Hammer Three-Star Motor Control offers 3-coil overload relays in all starter constructions and enclosures. Cutler-Hammer Motor Control with a 3-coil overload relay requires no special effort to install and uses the same space as a starter with a 2-coil overload relay. For complete ordering information write for the C-H Merchandiser. CUTLER-HAMMER Inc., 1306 St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.



CUTLER-HAMMER
MOTOR CONTROL
C-H



National Electric manufactures Silicone Insulated Wires and Cables with single or double fiberglass braid or silicone impregnated asbestos braid.

Silicone has outstanding properties and National Electric has

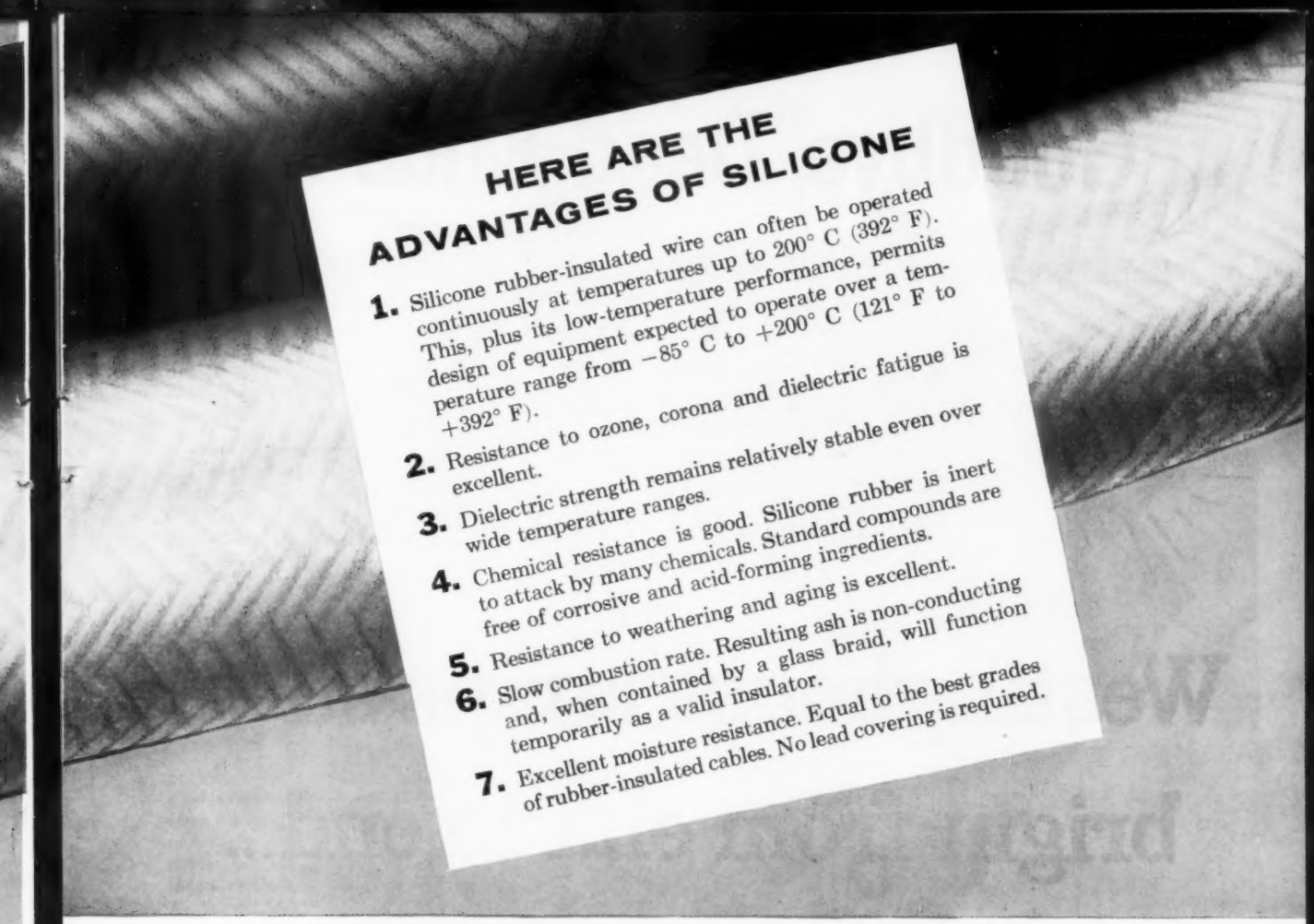
DON'T SAY ANY WIRE...SAY NE WIRE

Write for more information on National Electric Silicone Wire and Cables

National Electric Products

PITTSBURGH, PA.

2 Plants • 12 Warehouses • 41 Sales Offices



HERE ARE THE ADVANTAGES OF SILICONE

1. Silicone rubber-insulated wire can often be operated continuously at temperatures up to 200° C (392° F). This, plus its low-temperature performance, permits design of equipment expected to operate over a temperature range from −85° C to +200° C (121° F to +392° F).
2. Resistance to ozone, corona and dielectric fatigue is excellent.
3. Dielectric strength remains relatively stable even over wide temperature ranges.
4. Chemical resistance is good. Silicone rubber is inert to attack by many chemicals. Standard compounds are free of corrosive and acid-forming ingredients.
5. Resistance to weathering and aging is excellent.
6. Slow combustion rate. Resulting ash is non-conducting and, when contained by a glass braid, will function temporarily as a valid insulator.
7. Excellent moisture resistance. Equal to the best grades of rubber-insulated cables. No lead covering is required.

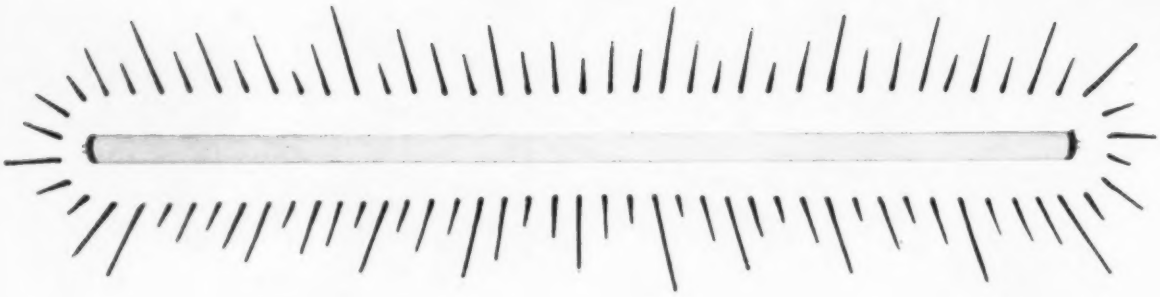
as a wire and cable insulation

the experience to develop them fully

And here are some of the companies that have successfully called on National Electric experience in the manufacture of silicone power and control cables:

Allis-Chalmers • Dow Chemical • Electric Boat Division of General Dynamics
Elliott Company • Inland Steel • United Engineering and Foundry
Westinghouse Electric

Goodbye, "Dead-Ends"!



Westinghouse lamps stay bright from end to end...

l-o-n-g-e-r !

New Westinghouse chrome vanadium alloy leads reduce end blackening—keep lamps bright end to end longer.
WESTINGHOUSE
40W COOL WHITE
U S A

"ULTRALUME" phosphors coat the inside of all Westinghouse fluorescent lamps. Only Westinghouse has "Ultralume"...the phosphors that assure maximum brightness for the life of the lamp.

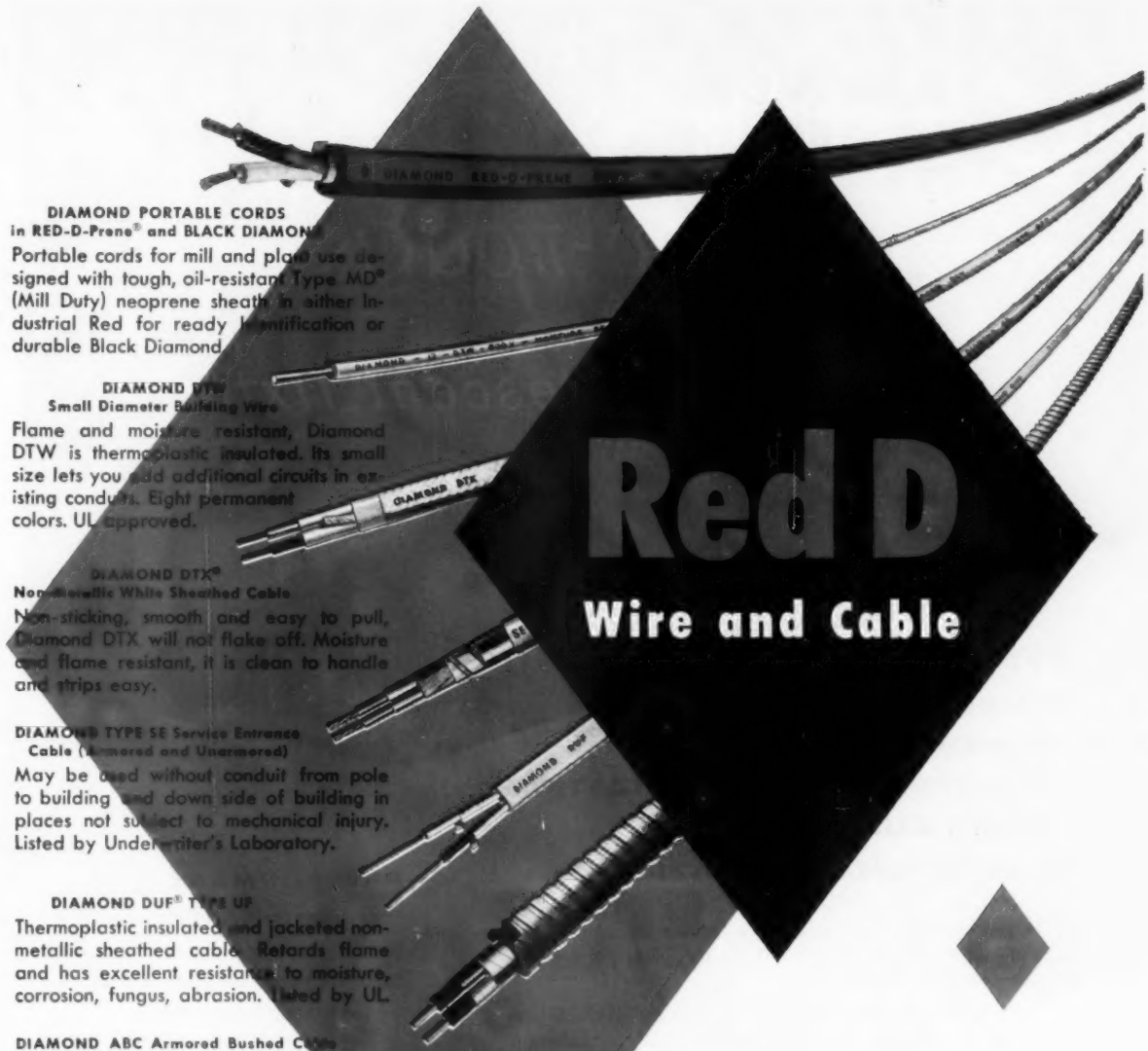
Banish light-robbing, unsightly "dead-ends" on your fluorescent lamps. Next time, use Westinghouse lamps with exclusive "Ultralume"™ phosphors and new chrome vanadium alloy leads. The combination of revolutionary new leads and Ultralume phosphors make Westinghouse lamps give maximum light longer and keep them bright end to end!

Save money, too! Lamp for lamp, Westinghouse fluorescents give more light for the same wattage. You get more light per foot . . . more light per dollar!

Specify Westinghouse on every lamp order. Call your local authorized Westinghouse agent or write—Westinghouse Lamp Division, Bloomfield, N. J.

YOU CAN BE SURE...IF IT'S

Westinghouse (W) FLUORESCENT LAMPS



DIAMOND PORTABLE CORDS
in RED-D-Prene® and BLACK DIAMOND

Portable cords for mill and plant use designed with tough, oil-resistant Type MD® (Mill Duty) neoprene sheath in either Industrial Red for ready identification or durable Black Diamond.

DIAMOND DTW®
Small Diameter Building Wire

Flame and moisture resistant, Diamond DTW is thermoplastic insulated. Its small size lets you add additional circuits in existing conduits. Eight permanent colors. UL approved.

DIAMOND DTX®
Nonmetallic White Sheathed Cable

Non-sticking, smooth and easy to pull, Diamond DTX will not flake off. Moisture and flame resistant, it is clean to handle and strips easy.

DIAMOND TYPE SE Service Entrance Cable (Armored and Unarmored)

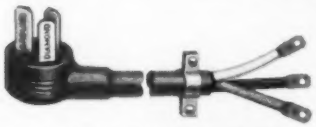
May be used without conduit from pole to building and down side of building in places not subject to mechanical injury. Listed by Underwriter's Laboratory.

DIAMOND DUF® TYPE UF

Thermoplastic insulated and jacketed nonmetallic sheathed cable. Retards flame and has excellent resistance to moisture, corrosion, fungus, abrasion. Listed by UL.

DIAMOND ABC Armored Bushed Cable

Flexible steel armored cable ideally suited for general lighting and wiring in non-fireproof homes. Two, three or four conductor.



DIAMOND RANGE CORD SET

Diamond three-wire range cord sets are 36" long. Have rubber molded cap, molded on rubber jacketed cable—are complete with steel strain relief. UL approved.

...known for Reliability in Performance and Delivery!

Diamond Wire Products are accepted as being the best in the industry. A continuing program of production control, research and product development helps maintain this reputation. And when your order for a Diamond product comes in . . . the goods go out, promptly and with no delay.

Trade Mark

DIAMOND
WIRE AND CABLE COMPANY
Sycamore, Illinois
Birmingham, Alabama

Guth brascolite

gives you Προ-πρᾶξις*

in EVERY incandescent fixture!

EVERY
Brascolite Fixture has a
- **BRIGHTNESS CHART**
- **COEFFICIENTS OF UTILIZATION**
- **LIGHT CURVE**

for better lighting specifications

When you figure an incandescent lighting installation, you naturally want assurance that you'll get the on-the-job performance you need.

Guth gives you this assurance with PRE-FORMANCE, *predetermined* performance that means each Brascolite incandescent fixture will do the job it's supposed to.

Every Brascolite fixture, including the handsome square recessed unit shown above, has a brightness chart, coefficients of utilization and light curve, and other engineering information to help you.

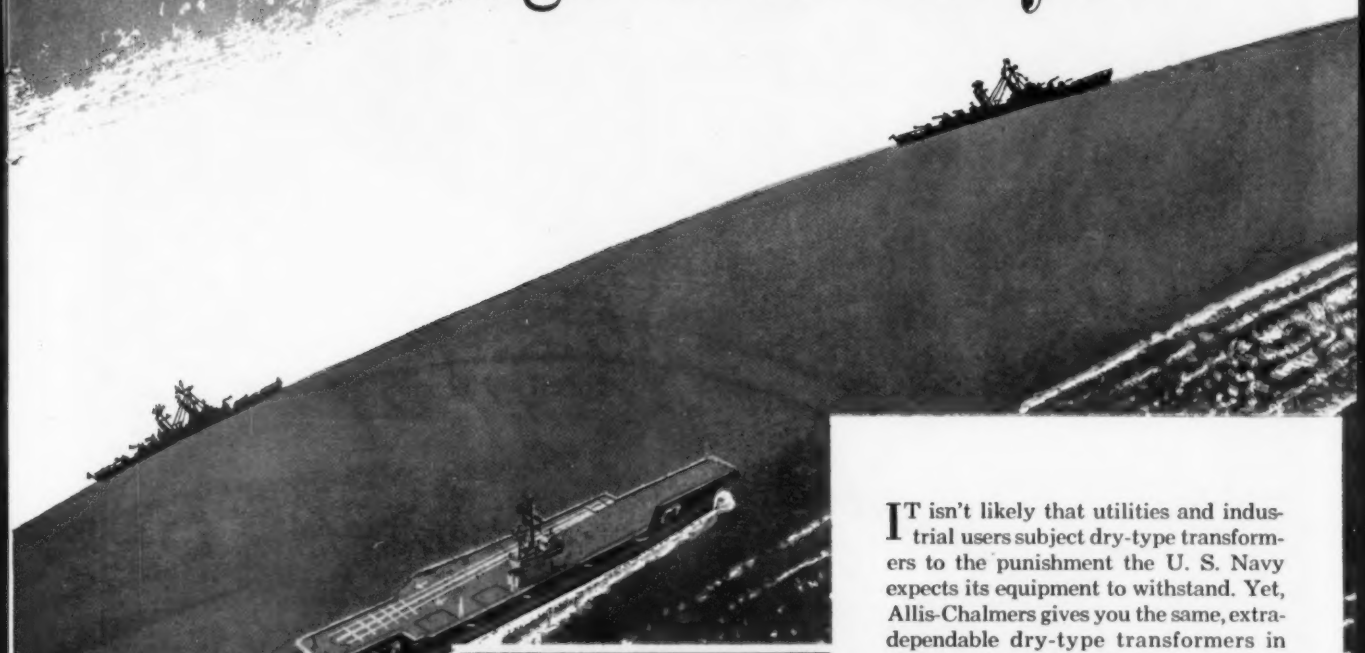
And every Brascolite fixture is a carefully engineered unit, with all parts working harmoniously to produce the finest and most efficient lighting possible.

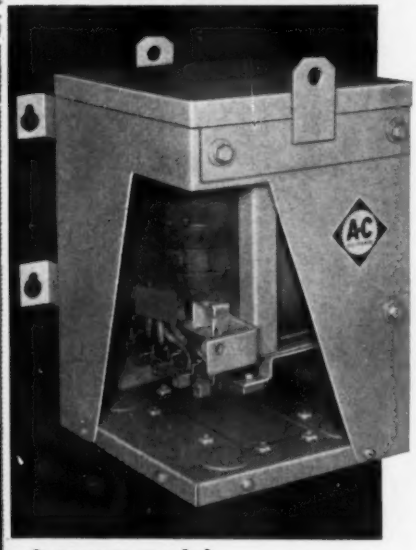
* **PRE-FORMANCE:**
Predetermined Performance
through careful engineering... takes the guesswork out of lighting calculation

FREE—*Guth Brascolite Incandescent Lighting Handbook, a complete working tool from which you can figure any incandescent lighting job. Write on your letterhead for your free copy today.*

THE EDWIN F. GUTH COMPANY ■ 2615 Washington Ave., St. Louis 3, Mo.

Are Your Transformer Requirements as Tough as the Navy's?





Cutaway model. Transformers are available in single-phase and three-phase designs, ranging from 3 to 75 kva, 600 volts or less.

IT isn't likely that utilities and industrial users subject dry-type transformers to the punishment the U. S. Navy expects its equipment to withstand. Yet, Allis-Chalmers gives you the same, extra-dependable dry-type transformers in "industrial-type" enclosures that the Navy installs in supercarriers, guided-missile destroyers and mine sweepers.

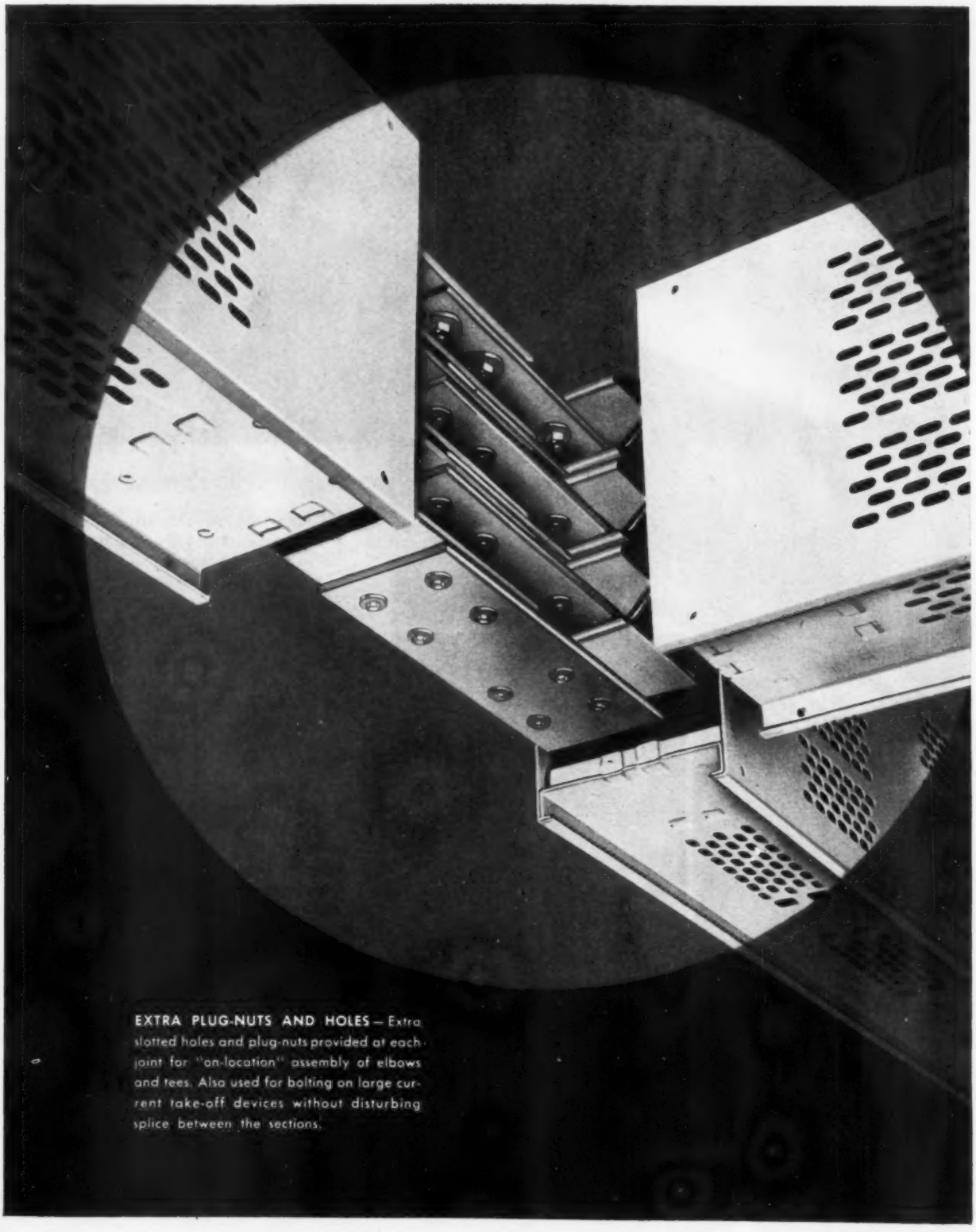
Allis-Chalmers totally enclosed dry-type transformers can save you as much as 20% on initial cost in place of an oil-filled unit. They are more economical to operate and can actually increase production. These units can be located outdoors, they're weatherproof—or indoors in dusty, lint-filled or moist atmospheres. They are quickly and easily mounted on walls, posts or machinery. Maintenance is virtually eliminated because there is no cooling liquid to change or filter — the coil is given maximum protection with high temperature insulating materials consisting of Fiberglas, asbestos based materials and silicone varnish.

For complete information, call your nearby A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-5637

ALLIS-CHALMERS

ADVANCED DESIGN FEEDER



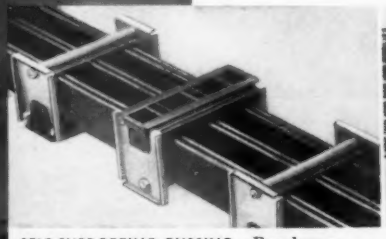
EXTRA PLUG-NUTS AND HOLES – Extra slotted holes and plug-nuts provided at each joint for "on-location" assembly of elbows and tees. Also used for bolting on large current take-off devices without disturbing splice between the sections.

and PLUG-IN LOW IMPEDANCE

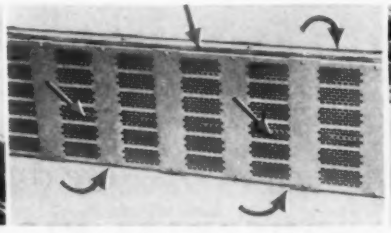
BUS DUCTS

For easy field assembly of Tees and Elbows

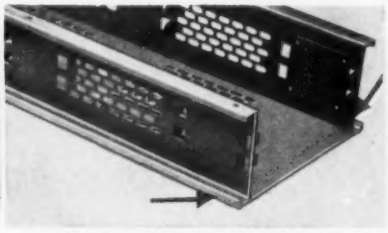
Federal Pacific's design ingenuity is revealed again in this remarkable new bus duct development. Designed to provide unrivaled on-the-job flexibility and complete installation economy—this improved design eliminates costly factory-made tees and elbows... allows you to fabricate them (at joints) during installation. Approved by Underwriters' Laboratories, Inc., and designed to NEMA standards —the improved duct retains all the valuable characteristics of standard low-impedance duct plus these additional features.



SELF-SUPPORTING BUSSING—Bus bar assembly is self-supporting and independent of housing; molded phenolic blocks, bolted together, hold bus bars firmly in place on 11" centers.

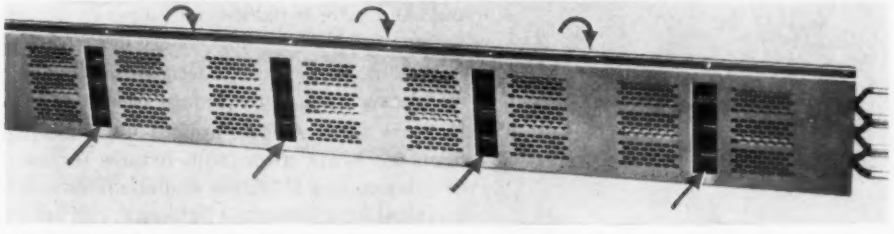


TOTALLY VENTILATED HOUSING—Top and bottom channels of the new feeder and Plug-In ducts are ventilated in addition to front and back covers.



ADDED STRENGTH AND RIGIDITY—Three sides of the housing are welded together for strength and rigidity to provide long service life. Cover is bolted on for easy accessibility to bus bar assembly.

NEW PLUG-IN LOW IMPEDANCE DUCT



PLUG-IN OPENINGS EVERY 11 INCHES—The convenience of a take-off tap from L.I. Feeder duct is now possible with this new Plug-In Low Impedance duct. It has all construction features shown—including the extra plug nuts and holes for field assembly of Tees and Elbows. Insulated phenolic "supports" extend through front and back covers and function as plug-in openings. Within insulated plug-in, one bar of each phase has insulation removed where plug-in stab makes contact with bus bar.

For complete details, write:

Federal Pacific Electric Company, 50 Paris Street, Newark 1, N. J.

FEDERAL FPE PACIFIC

Better Products to Control Electricity

"Glare-less" Lighting with Mercury Uplight Units
Abolite's 24" wide Alzak aluminum uplight fixtures used with H 400-RC1 mercury lamps. Ceiling height is 35'; fixture height, 27' 10", with 20' spacing. 90% of lamp's lumens are useful. Average footcandle level is 35.

Now Abolite brings "office type" eye comfort to...

INDUSTRIAL HIGH BAY LIGHTING

Abolite open-top units direct only a small amount of light (18%) upward, but it makes a big difference in eye comfort. Dark ceiling shadows are washed away—there's no sharp contrast of bright light against black background. And glare is reduced still more by 35° lamp shielding. As a result, eye fatigue is reduced—workers are more efficient.

Abolite's modern air-swept design also reduces maintenance costs because air circulating through the fixture sweeps it clean of dulling dust.

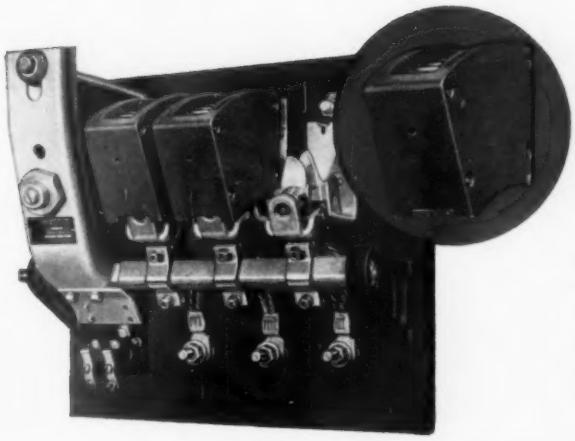
There are three Abolite uplight units for high bay lighting: 18" and 24" diameter Alzak aluminum fixtures for use with 400 and 1000 watt mercury lamps and 18" Alzak aluminum fixtures for 500 watt incandescent lamps (ideal for gymnasium lighting). For full information on these units, see Sweet's Industrial Construction File, 12i/AB.

ABOLITE Lighting

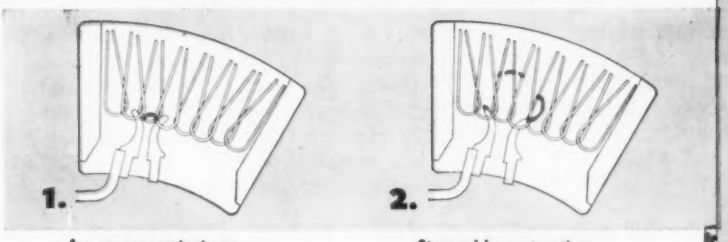
THE JONES METAL PRODUCTS COMPANY
West Lafayette, Ohio

for fast arc interruption... without blowout coils

ALLIS-CHALMERS
TYPE 425 CONTROL
featuring ACBO arc-centering blowout chutes for 50 to 400 hp



The advanced electrical design of Allis-Chalmers Size 4, 5 and 6 control incorporates a modern principle of arc interruption for low voltage, high horsepower applications. The *ACBO* arc chute utilizes principles of magnetic action and thermal convection to center, rupture and extinguish the arc . . . quickly. Fast arc interruption assures maximum contactor efficiency, improves performance — greatly prolongs contact and chute life.

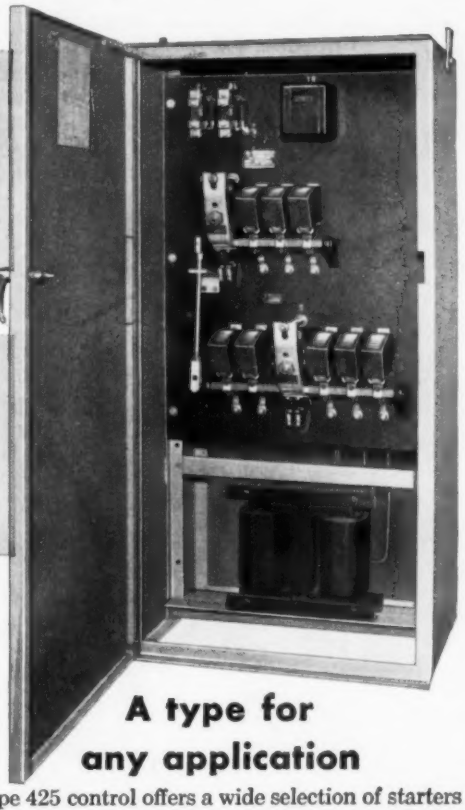


Arc across contacts as they start to open.

Strong blowout action forces arc to center.

Arc rupturing.

Contacts fully open—arc extinguished.



Simplified mechanical design

- Streamlined clapper-type construction eliminates many parts.
- Accessibility simplifies maintenance and inspection.
- Installation is fast and easy . . . sensible enclosure dimensions provide ample wiring space.

A type for any application

Type 425 control offers a wide selection of starters and contactors for any application. For detailed information, call your A-C Control Distributor or your local A-C District Office . . . or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin. Ask for Bulletin 14B8615.

ACBO is an Allis-Chalmers trademark.

A-5343

ALLIS-CHALMERS

Why Uptegraff TRANSFORMERS withstand exceptional service stresses

Balanced insulation design is the reason.

The benefits of Uptegraff's "balanced" insulation design are—a high level of transformer performance and longer service life . . . through capacity beyond its normal rating to withstand transient overvoltage conditions.

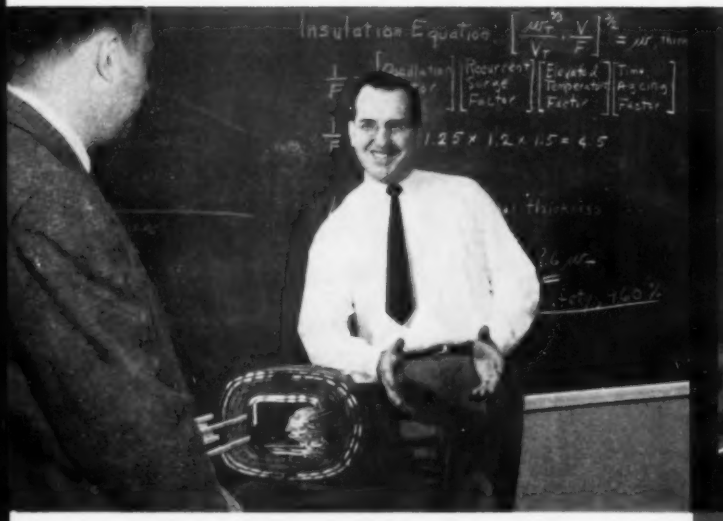
Uptegraff achieves this "balanced" insulation design by research, experimentation and testing. This means that our engineers are collecting data of various types of actual field service conditions, appraising this data relative to insulation stresses, and persistently searching and analyzing new and better insulation materials and fabrication methods.

But that's not all. Strict quality-control in the actual fabrication of coil windings and thorough testing of sub-assemblies and of the finished product are also important. The result is transformers with an extra margin of safety—making allowances for recurrent overvoltages, high temperatures, aging, conductor shape factors and other considerations.

Write, today, for descriptive literature on any of Uptegraff's major types of transformers . . . Power, Distribution, Lighting, Load Center, Network, Instrument, Specialty. Types and sizes for all classes of service . . . up to 10,000 kva.

R. E. UPTEGRAFF MANUFACTURING COMPANY

SCOTTDALE, PENNSYLVANIA

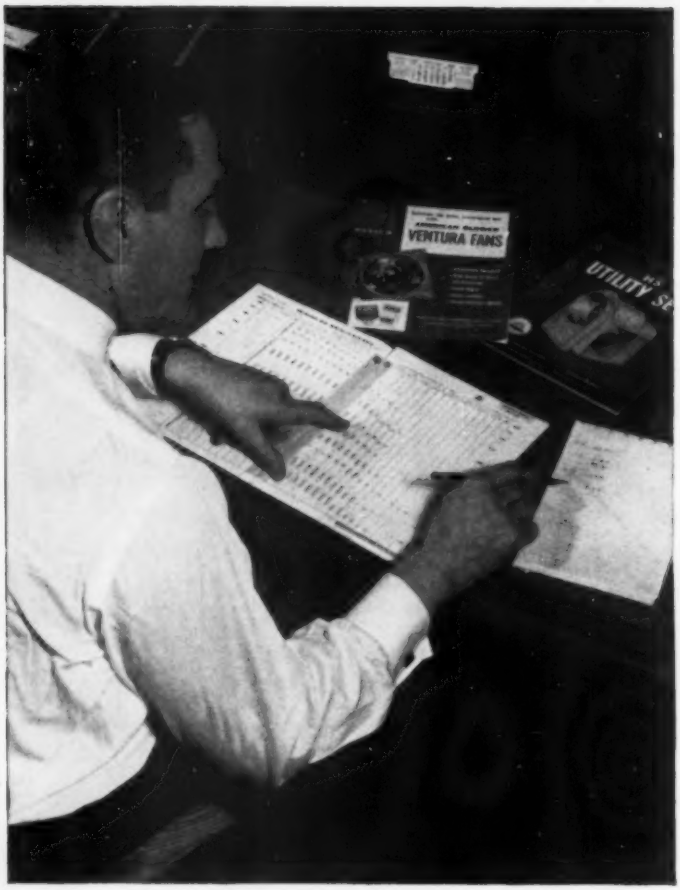


Uptegraff's unrelenting objective is to design insulation which meets specific service requirements and assures maximum insulation utilization.

Coil winding of Uptegraff transformers is carefully supervised by craftsmen who have 20, 25, and 30 years of experience in transformer building.

Uptegraff's superior transformer performance in actual field service is assured by obtaining an understanding of the voltage distribution in the windings under transient conditions. Here a transient analyzer is being used to study the transient voltages in the windings of a 3750 kva transformer.

"PRE-ENGINEERED" VENTILATION



— another example of how you benefit when you install American Blower ventilating equipment

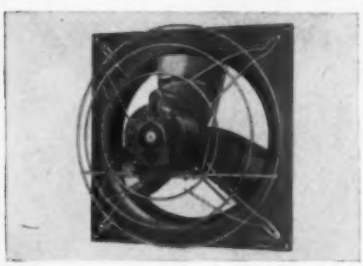
Show your prospects how to improve employee efficiency and morale quickly, economically. Sell them good ventilation, *pre-engineered* by American Blower.

Sales point: No on-the-job engineering is needed when your customers ventilate with American Blower equipment. Our engineers already have designed and tested a fan exactly right for *any* job. So it's easy to pick the proper model directly from the catalog. And you offer buyers even *more:*

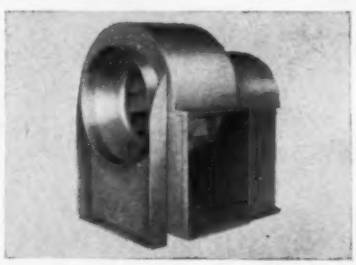
- **Packaged ventilation** — Complete, ready to use. Fast, economical installation.
- **"Off-the-shelf" delivery** — Fast service from *local* stocks on most models.
- **Certified Ratings** — Air deliveries meet rigid standard test codes.

Ring up *more* sales with the *complete* line of American Blower fans for every ventilating job. Bonus: equipment selection assistance from one of our 73 branch offices. For details, write: American-Standard,* American Blower Division, Detroit 32, Mich. In Canada: Canadian Sirocco products, Windsor, Ontario.

It pays to standardize on American Blower!



Ventura Fans — quiet, efficient, economical. Sizes from 10" to 30".



Utility Sets — Direct drive, sizes 3" to 12¼"; V-belt drive, 9" to 36".

Power Roof Ventilators — available through American Blower branches.

* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
AMERICAN BLOWER DIVISION

Now for "Preferred-Emergency" Switching

an Off-the-Shelf

AUTOMATIC TRANSFER PANEL

With *Any Desired* Throwover Scheme ...at the *Flip of a Switch!*

A Flip of the Switch Gives You:

- Choice of making either source preferred.
- Choice of automatic or manual (semi-automatic) return.
- Adjustable time delays —range up to 10 minutes.
- Optional manual operation of line switches.
- Choice of returning: in either open or closed transition (with or without paralleling).
- Optional lockout on bus faults.

Other Unique Features:

- Indicating lamps for switch positions, live sources, and lockout action.
- Alarm to prevent leaving panel set on "manual operation."
- Transparent cover over selector switches prevents unintended changes in settings.

You don't have to design and build (or negotiate for) — your special automatic transfer panels in order to get the special specific throwover schemes you need. The new S&C Automatic Transfer Panel will give you any or all throwover options... selector switches give the scheme you want!

With this new stock panel you can eliminate the engineering and correspondence involved in getting custom-built panels.

Furthermore, you are sure of getting what you want today; tomorrow you can change your mind, and later you can revise the scheme—still using the same transfer panel. Imagine! You can order your panel ahead of time, before specifications are settled.

Saves Time and Money

— Buy from our stock for your stock —

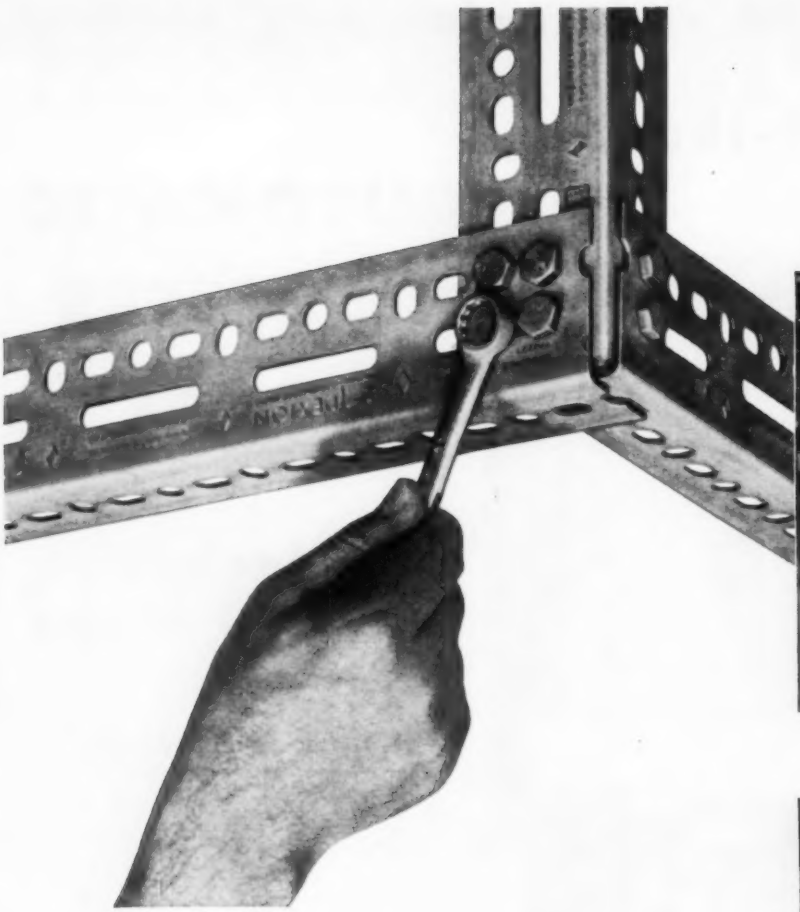
Specialists in High-Voltage Circuit Interruption since 1910

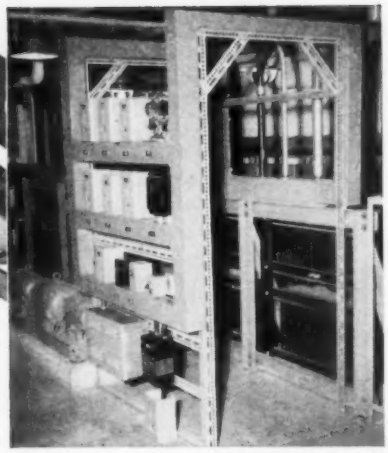
S&C ELECTRIC COMPANY

4433 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

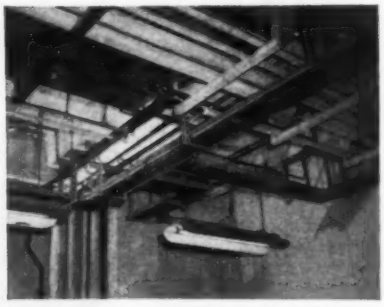
In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

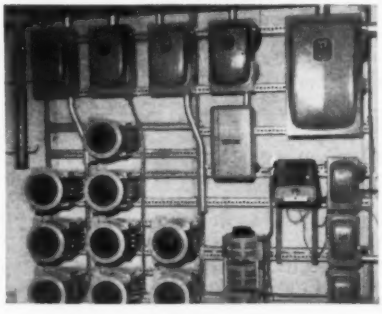




ACME STEEL Dexion Slotted Angle used to frame electronic brain control center.



ACME STEEL Dexion Slotted Angle frames troughs holding electrical cables.



ACME STEEL Dexion Slotted Angle supports instrument and electrical panel.

Cut your costs with ACME STEEL Dexion Slotted Angle

the Idea material for all electrical installations

You can install switchgear, conduit, cable, outlets, relays and control boxes more easily, quickly and at reduced cost with Acme Steel Dexion Slotted Angle.

Dexion Slotted Angle measures, cuts and bolts, all at the job site. It is light, compact and packaged in convenient 10-piece units, complete with nuts and bolts.

Precision-engineered slot and hole patterns always match up, making framing and installing electrical equipment fast and easy. Mounting holes are instantly available. Dexion Slotted Angle is strong, too, supports hundreds of pounds with ease. A wrench and the portable Dexion Cutter are the only tools needed. No drilling or welding—merely cut and bolt Dexion pieces to your exact specifications.

Contractors who stock and regularly use cold-rolled, galvanized Dexion Slotted Angle find it makes important contributions to installation quality and cost reductions.

See how Dexion Slotted Angle has *worked* for other contractors. For cost-cutting electrical installation ideas write Dept. EBD-48, Acme Steel Company, Chicago 27, Illinois.

ACME STEEL **DEXION SLOTTED ANGLE**

No plastic electrical tape resists flame like SCOTCH No. 33!

REG. U. S. PAT. OFF.
BRAND

"SCOTCH" Brand No. 33 Electrical Tape has a greater resistance to burning than any other plastic tape! And remember, only the genuine "SCOTCH" No. 33—*invented* as a new type of wire splice covering—has "Scotty's" plaid on the can and "No. 33" inside the red core. Ask your distributor about the full line of "SCOTCH" Brand splicing materials, or write us for complete information.

"SCOTCH" and the plaid design are registered trademarks of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn.

The price per splice is less! Let us prove it!

MINNESOTA MINING AND MANUFACTURING CO.,
St. Paul 6, Minn., Dept. CB-48

All right!—*show* me! Send someone around to prove that the price per splice of "SCOTCH" No. 33 is less!

NAME.....

COMPANY.....

ADDRESS.....

CITY.....ZONE...STATE.....

MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

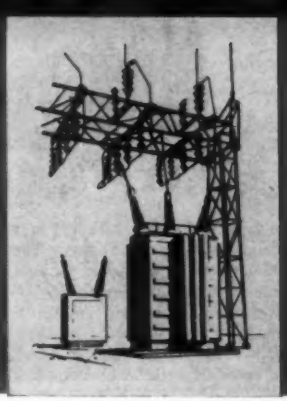
AMP COMPRESSION for the

ALL TERMINALS SHOWN ACTUAL SIZE

SOLISTRAND®	Ampli-Bond®	DIAMOND GRIP	PRE-INSULATED DIAMOND GRIP
22-600 MCM AWG	8-4/0 AWG	26-10 AWG	26-10 AWG

SOLISTRAND Butt and Parallel Connectors for innercoil connection to leads. SOLISTRAND Terminals on outside leads of transformers.

PRE-INSULATED DIAMOND GRIP and DIAMOND GRIP Terminals and Connectors for switchgear panel wiring in generator plants and sub-stations.



SOLISTRAND and AMPLI-BOND Terminals and Connectors for construction and maintenance of generator plants and sub-stations.

PRE-INSULATED DIAMOND GRIP and SOLISTRAND Terminals and Connectors for street and traffic light installation and maintenance.

TERMINAL PRODUCTS UTILITY INDUSTRY...

AMP's diversified lines of terminal and connector products . . . and matched precision-engineered application tooling . . . have been part of the utility industry's components story, in many ways, for many years. These products have been designed for the exacting requirements of the electrical industry in general, and a predominant number of original equipment items depend on the AMP method of termination and connection for service reliability.

AMP's diversified lines of terminal and connector products include:

SOLISTRAND®—of one-piece construction, for application to stranded, solid or irregularly shaped conductors.

Ampli-BOND®—provide full insulation support for large wire sizes. They are bonded and reinforced to prevent relaxation of cable support.

DIAMOND GRIP—non-insulated, but having metallic sheath to provide full circumferential support to cable. Excellent for applications where resistance to vibration is a factor.

PRE-INSULATED DIAMOND GRIP—insulated with tough plastic that won't come off . . . it's bonded. Affords optimum performance under vibration.

Some typical applications of these A-MP products are shown below.

AMP's continuing programs of research and development are increasing the potential of newer products to speed operations, reduce costs, and improve reliability for all phases of utility activity.

A-MP products, when required for maintenance and repair needs, are available in the U. S. A. through American Pamcor Inc. api AMERICAN PAMCOR INC.

For additional information write to:

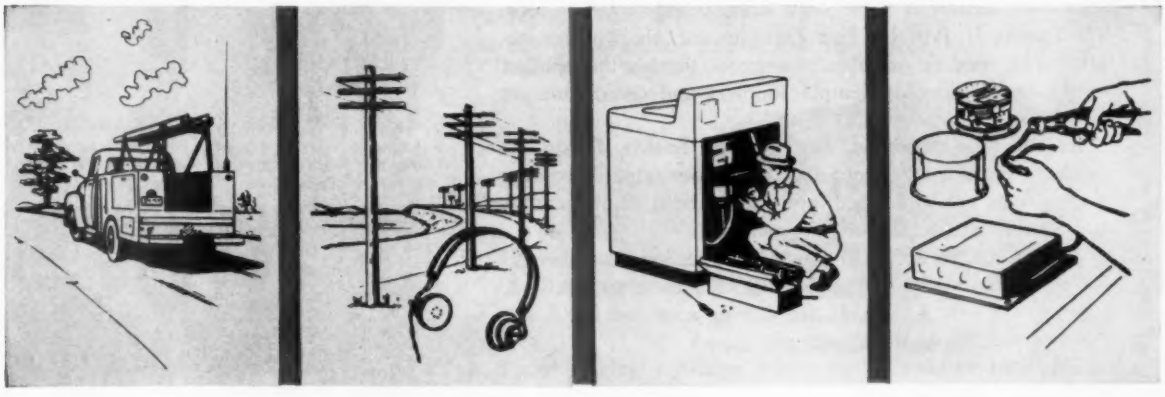
AMP INCORPORATED

General Offices:

7337 Eisenhower Boulevard, Harrisburg, Pa.

Wholly Owned Subsidiaries: Aircraft-Marine Products of Canada, Ltd., Toronto, Canada • Aircraft-Marine Products (Great Britain) Ltd., London, England • Societe AMP de France, Le Pre St. Gervais, Seine, France • AMP—Holland N.V. 's-Hertogenbosch, Holland

Distributor in Japan: Oriental Terminal Products Co., Ltd., Tokyo, Japan

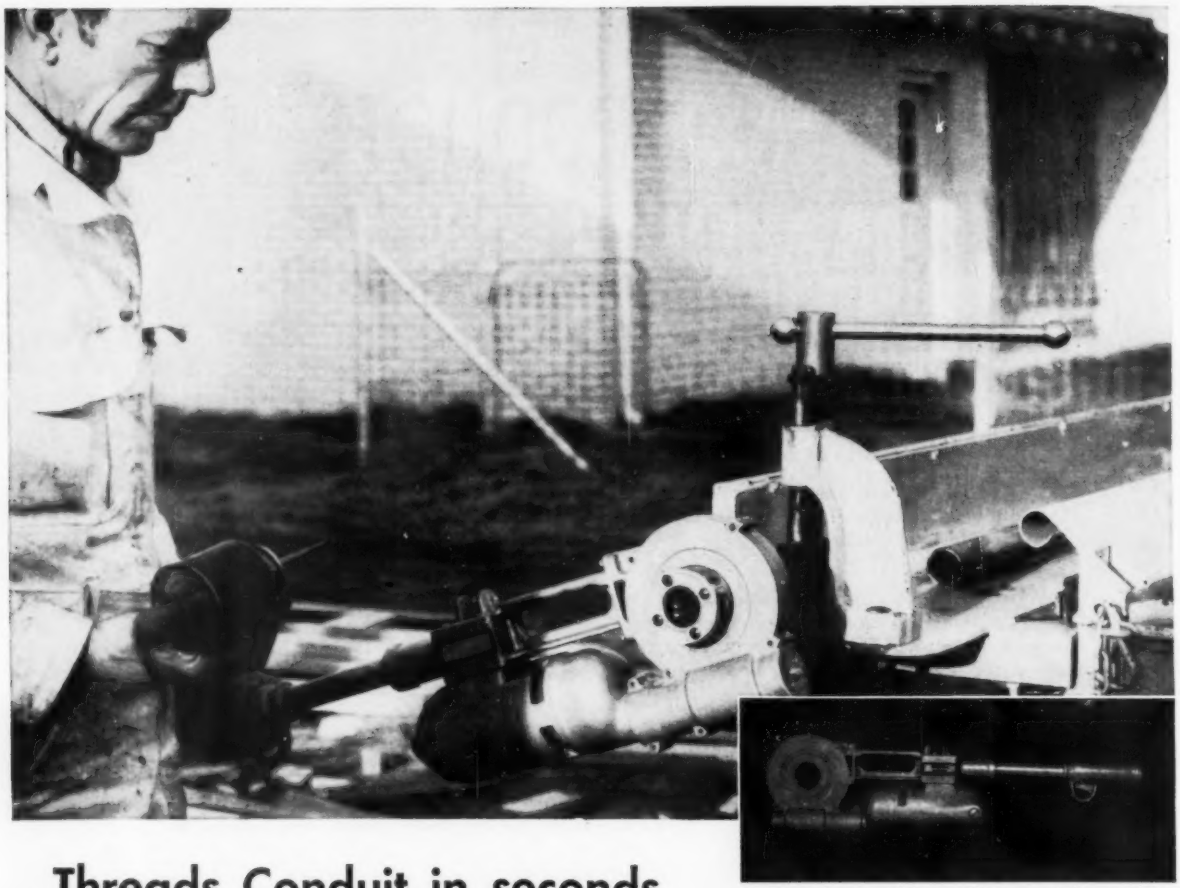


PRE-INSULATED DIAMOND GRIP, DIAMOND GRIP, and SOLISTRAND types find extensive usage in truck and car fleet maintenance.

PRE-INSULATED DIAMOND GRIP Terminals and Connectors for communications equipment.

PRE-INSULATED DIAMOND GRIP, DIAMOND GRIP and SOLISTRAND types for appliance repairs.

PRE-INSULATED DIAMOND GRIP, DIAMOND GRIP and SOLISTRAND types for meter repairs.



The Lawco, Jr.—portable, versatile, compact. Does a variety of jobs faster, better.

Threads Conduit in seconds

...*the Lawco, Jr.*

PORTABLE PIPE THREADER

Here's the answer to those slow, tiring, hand-threading jobs. The Lawco, Jr. Portable Pipe Threader does the work in seconds. This modern portable power tool threads the smallest to the largest conduit. Simple adapters and speed reducers handle pipe from ¼-inch to 6".

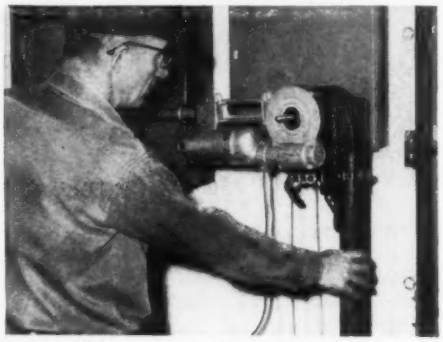
Its operation is simple. Just position Lawco, Jr. on the conduit, press the trigger, and the power unit drives the cutting dies. You're finished in no time, and right at the location where you are installing the conduit.

And Lawco, Jr. comes in handy for other jobs, too. Several are illustrated at the right. In addition to these applications, you can use your Lawco, Jr. for driving nuts and bolts, and hoisting weights up to 500 pounds.

This light weight (20 lbs.) tool is precision built for years of service. Write for details.

Augering operation with Lawco, Jr. Efficient in vertical or horizontal operations.

Post hole application using square shank. Lawco, Jr. does it faster.



There's nothing better for pulling wire through conduit than the Lawco, Jr. The unit's portable feature speeds work.

VELOCITY POWER TOOL CO.

201 North Braddock Avenue, Pittsburgh 8, Pa.

How to make money

foot after foot

Self-dispensing Carton with Inventory Keeper to minimize waste

Color-coded Labels to instantly identify insulation—red and white for neoprene, black and white for rubber

Foot-after-foot Imprint shows at a glance the gauge, number of conductors and type of insulation

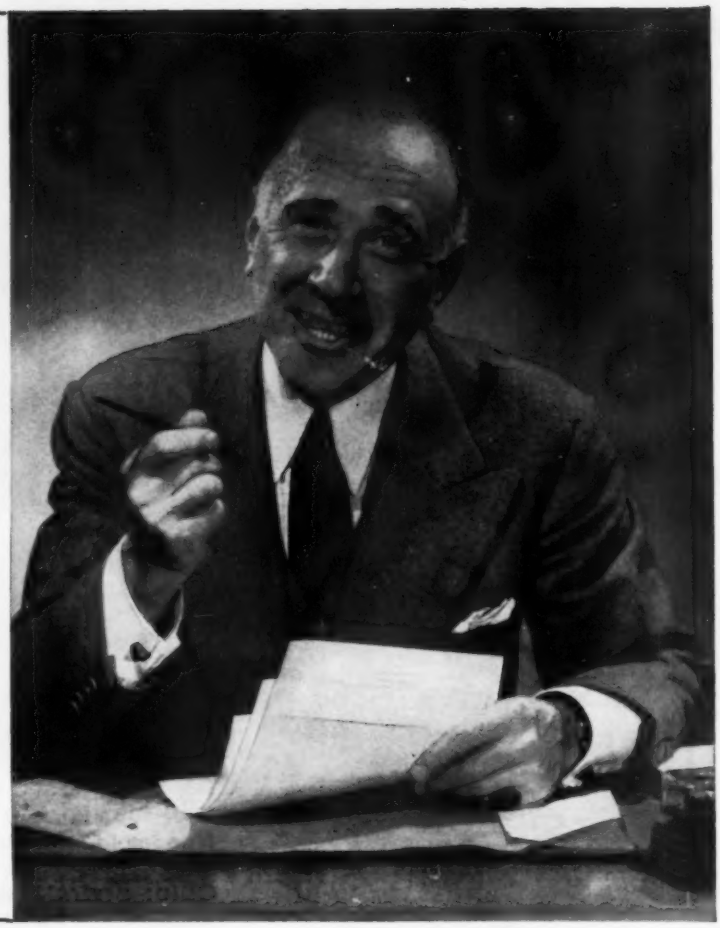
Why settle for less?
When you call for cable, call for Carol.

NEMA

Carol®

CAROL CABLE COMPANY
Division of The Crescent Company, Inc.
Pawtucket, Rhode Island

"I'm the best informed man in the business ...thanks to Dodge Reports"



"I've been in business long enough to think I know everybody around, but I've learned never to be surprised when my Dodge Reports show up good jobs I didn't know about."

Even the best informed old-timer can't match Dodge Reports for knowledge of all that's going on in the construction industry. That's because no successful contractor can spend *all* his time getting construction news. But Dodge reporters do just that—it's their only job. And every day the news they gather is mailed to contractors who use Dodge Reports. If you want to know what's going to be built, where it's going to be built, who the owner is, who's designing it and *even when the bids are wanted*, you can get this information for any area in which you operate within the 37 Eastern States.

This is not a year to gamble on getting your share of business and making a profit. Use Dodge Reports for the assurance of having the business opportunities you need. Send the coupon now for your copy of "Dodge Reports—How to use them effectively," including the famous "Dodge Specification Form" to help you figure out the kind, size, location, etc., of jobs you should go after.

F. W. Dodge Corporation, Construction News Division, Dept. 948
119 West 40th Street, New York 18, N. Y.

I want to know how to get more new construction business. Please let me see some typical Dodge Reports for my area. I am interested in the markets checked below:

☐ House Construction ☐ General Building
☐ Engineering Projects (Heavy Construction)

Area_____

Name_____

Company_____

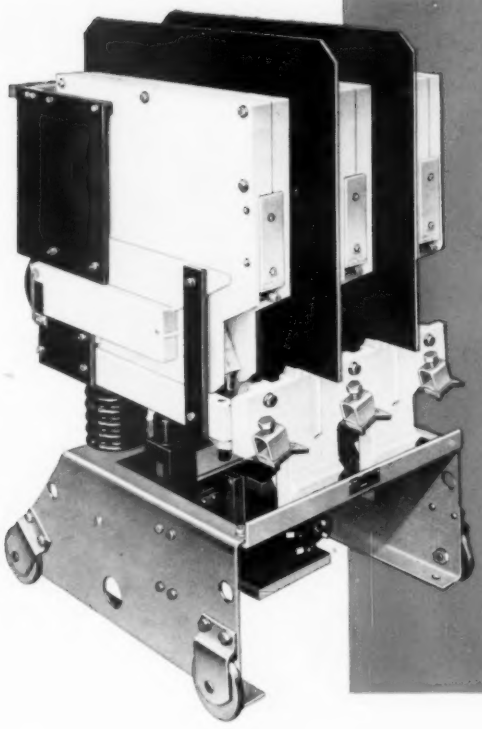
Address_____

City_____ Zone_____ State_____

F. W. DODGE CORPORATION

Dodge Reports

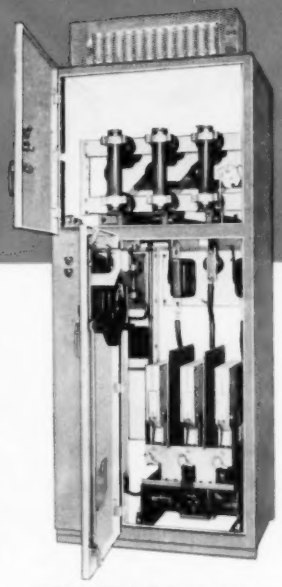
For Timed Selling to the Construction Industry



Air break starters

for high voltage motors

A-B QUALITY



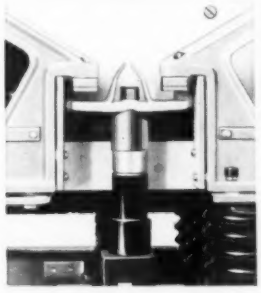
This *new* air break contactor—around which Allen-Bradley has developed a complete line of high voltage starters—is designed to match your *toughest* applications. It features the same solenoid design—with only *one* moving part—that has made Allen-Bradley low voltage starters universally recognized for their tremendous operating life.

These new contactors are available in full voltage and reduced voltage starters—nonreversing or reversing—for squirrel cage, part winding, slip ring, and synchronous motors up to 1500 hp, 2300 volts; 2500 hp, 4600 volts. All starters are equipped with current limiting fuses and have an interrupting capacity of 150,000 kva at 2300 volts and 250,000 kva at 4600 volts.

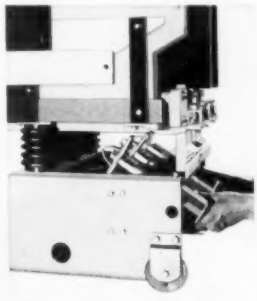
It will pay you to investigate these *quality* starters. Complete information is contained in Publication 6080 . . . please send for your copy, today.

Bulletin 966 high voltage air break, across-the-line synchronous motor starter in NEMA Type 1 enclosure.

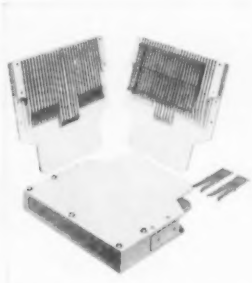
Only One Moving Part. Simple solenoid design eliminates trouble-causing pins, pivots, and flexible jumpers.



Double Break Contacts of silver alloy never need maintenance. Vertical motion assures uniform contact pressures.



Easy Access from Front. Crossbar and contacts removable from front, without special tools, for easy inspection.



Faster Arc Suppression. New blowout design and novel arc chute. Chutes are molded from an arc resistant material.

Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd.
Galt, Ontario

5-58-MR

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Husky

BULLETIN 801

LIMIT SWITCHES

IN A THOUSAND AND ONE TYPES

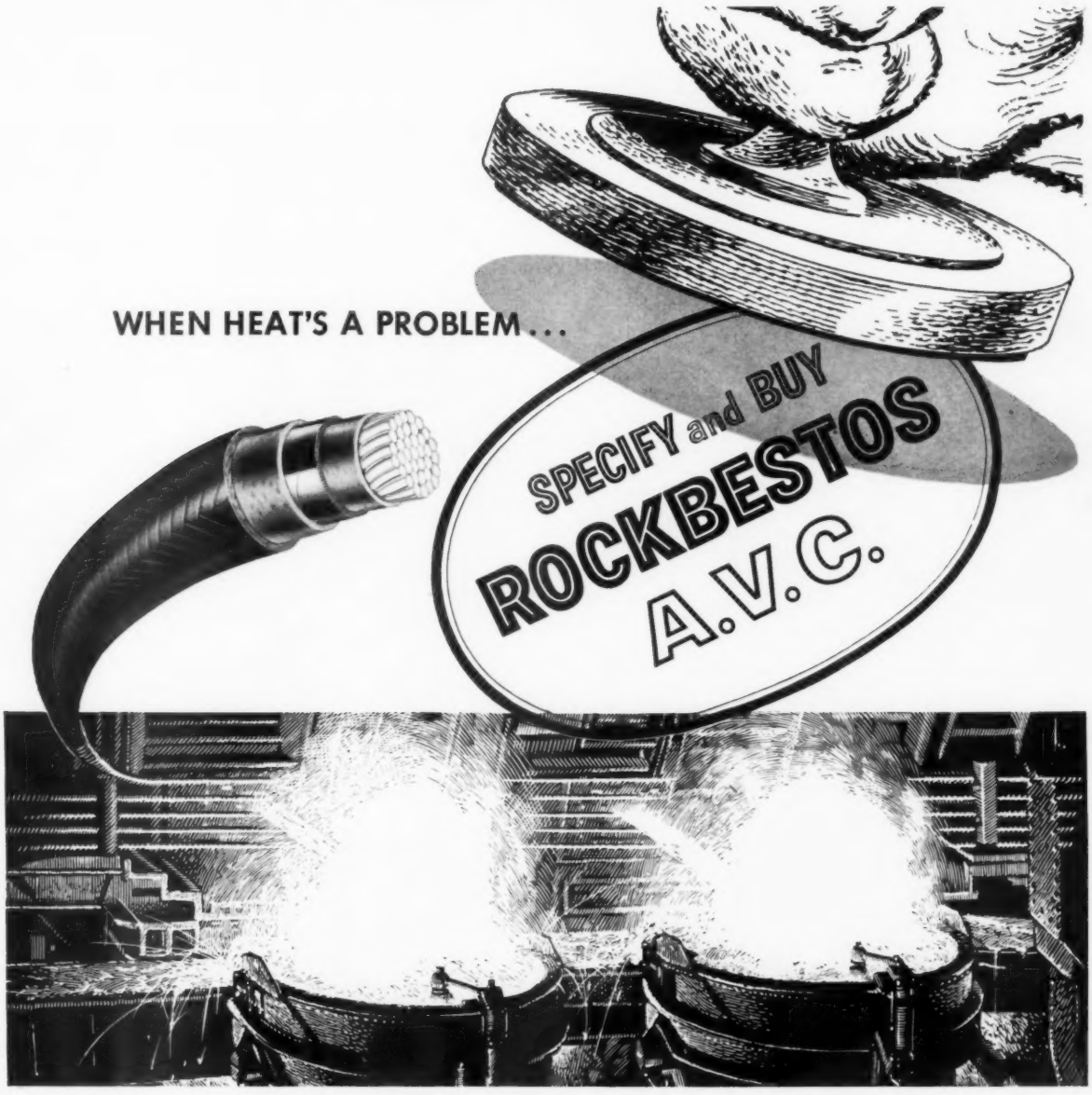
A-B
QUALITY
Roller lever type in watertight enclosure.
Cutaway view of Bulletin 801 heavy duty limit switch. Note the sturdy construction.
Roller fork type in watertight enclosure.
Lever type for rod or chain operation.
Push type, heavy duty switch.
Center roller, standard duty switch.
Switch with two independently adjustable rollers.
Fork type, snap action switch.

From among the hundreds of Allen-Bradley Bulletin 801 general purpose limit switches, you're sure to find your exact requirements. There are 21 different contact arrangements available, including types with single or multiple poles, N.O. and N.C. contacts, spring return or maintained contacts, with either a slow or snap action mechanism. It will pay you to know this *quality* line of limit switches. If you do not already know this quality line, let's get acquainted. Write for the complete story.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

5-58-MR



Steel Mill and Foundry "hot spots" provide one of industry's worst torture chambers for wire and cable. Heat, overloads and corrosive fumes combine to kill ordinary cable quickly.

Don't take a chance on ordinary cable for troublesome "hot spot" applications. *Specify and use Rockbestos A.V.C.*

This superior AVA cable, with asbestos, varnished cambric insulation, takes temperatures up to 230°F, assuring continuous operation in hot spot applications, provides greater current carrying capacity for increased and new loads.

When you *specify and buy Rockbestos A.V.C.*, you reduce your electrical maintenance and construction costs . . . you get years more dependable service.

Write now for the new Rockbestos RSS-88 to help you *specify and buy Rockbestos A.V.C.*

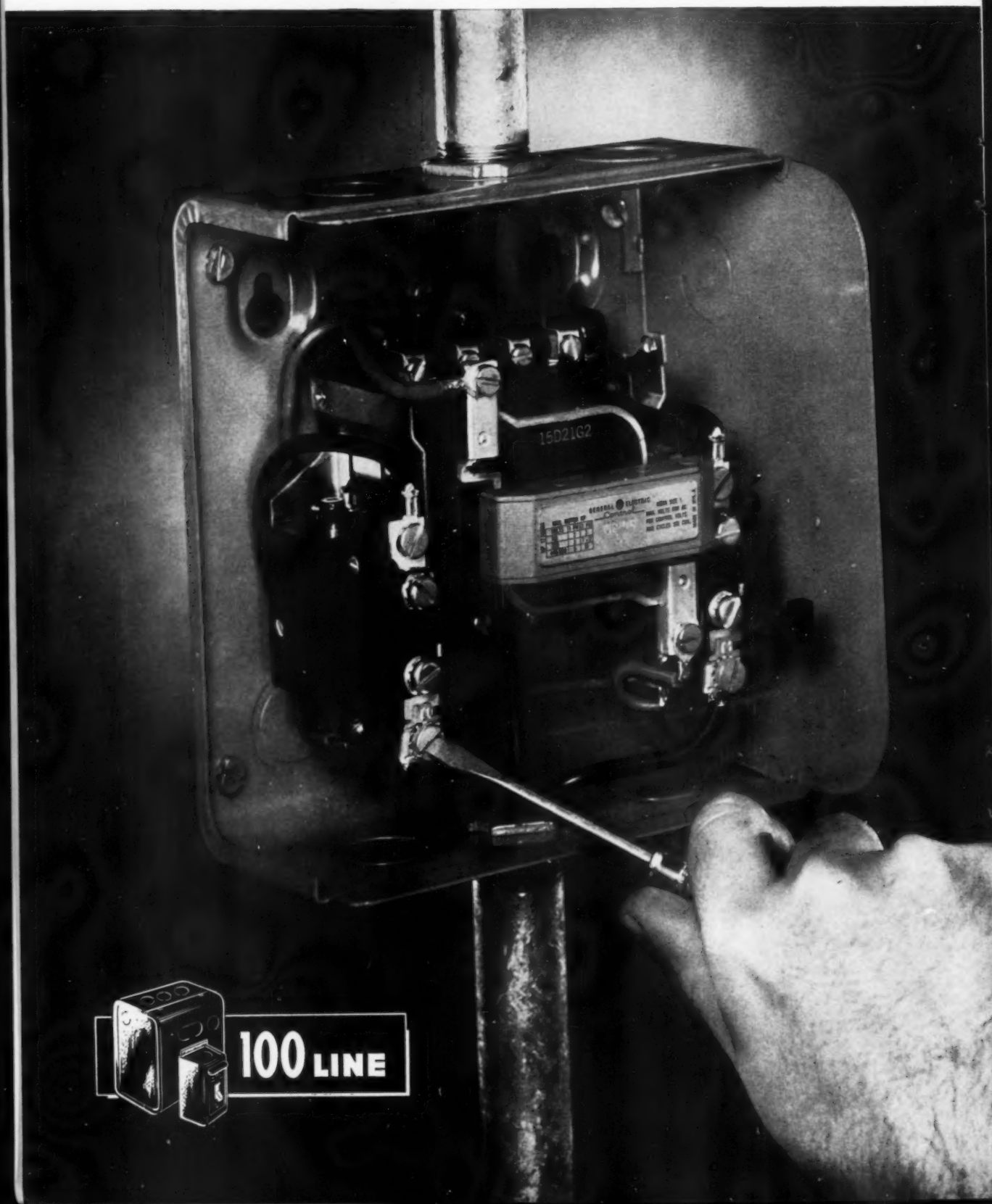
ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT • CHICAGO • OAKLAND
PITTSBURGH • ST. LOUIS • LOS ANGELES • SEATTLE • ATLANTA • DALLAS

ROCKBESTOS A.V.C.

THE SUPERIOR A.V.A. CABLE

"STRAIGHT-THROUGH" WIRING, 32% MORE



WIRING ROOM MAKE NEW GENERAL ELECTRIC SIZE 0 AND 1 MAGNETIC STARTERS

EASY TO INSTALL

These new, radically different General Electric magnetic starters can save you installation time and money. Here's how:

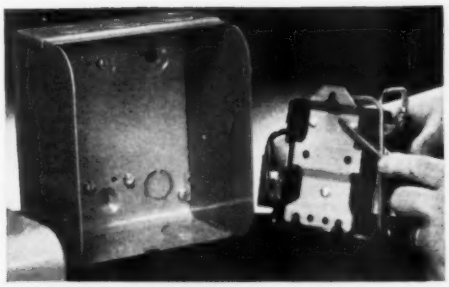
STRAIGHT-THROUGH WIRING. All line terminals are at the top and all load terminals are at the bottom of the new G-E magnetic starter. Straight-through wiring and new pressure-type terminals save you time because no wires need be bent or looped. All wiring is done from the front where it's easy to see and reach.

32% MORE WIRING ROOM. The new General Electric magnetic starter is smaller than previous forms but still leaves more room for wiring even with both sides on. Both the enclosure cover and sides are easy to remove. Just press the spring-clip latch, and the wrap-around cover is released. A half turn of two screws and you can remove each side for "extra" wiring room.

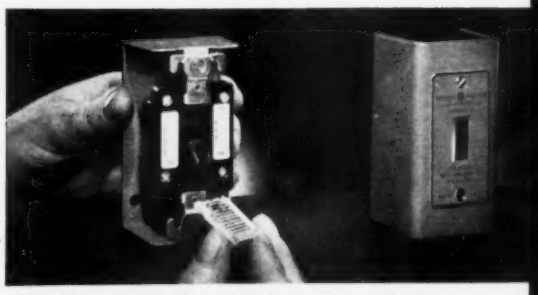
Like more information? Contact your nearby G-E Apparatus Distributor, or write to Section 733-40, General Electric Company, Schenectady, N. Y. and ask for bulletin GEA-6611.

General Purpose Control Department, Bloomington, Illinois.

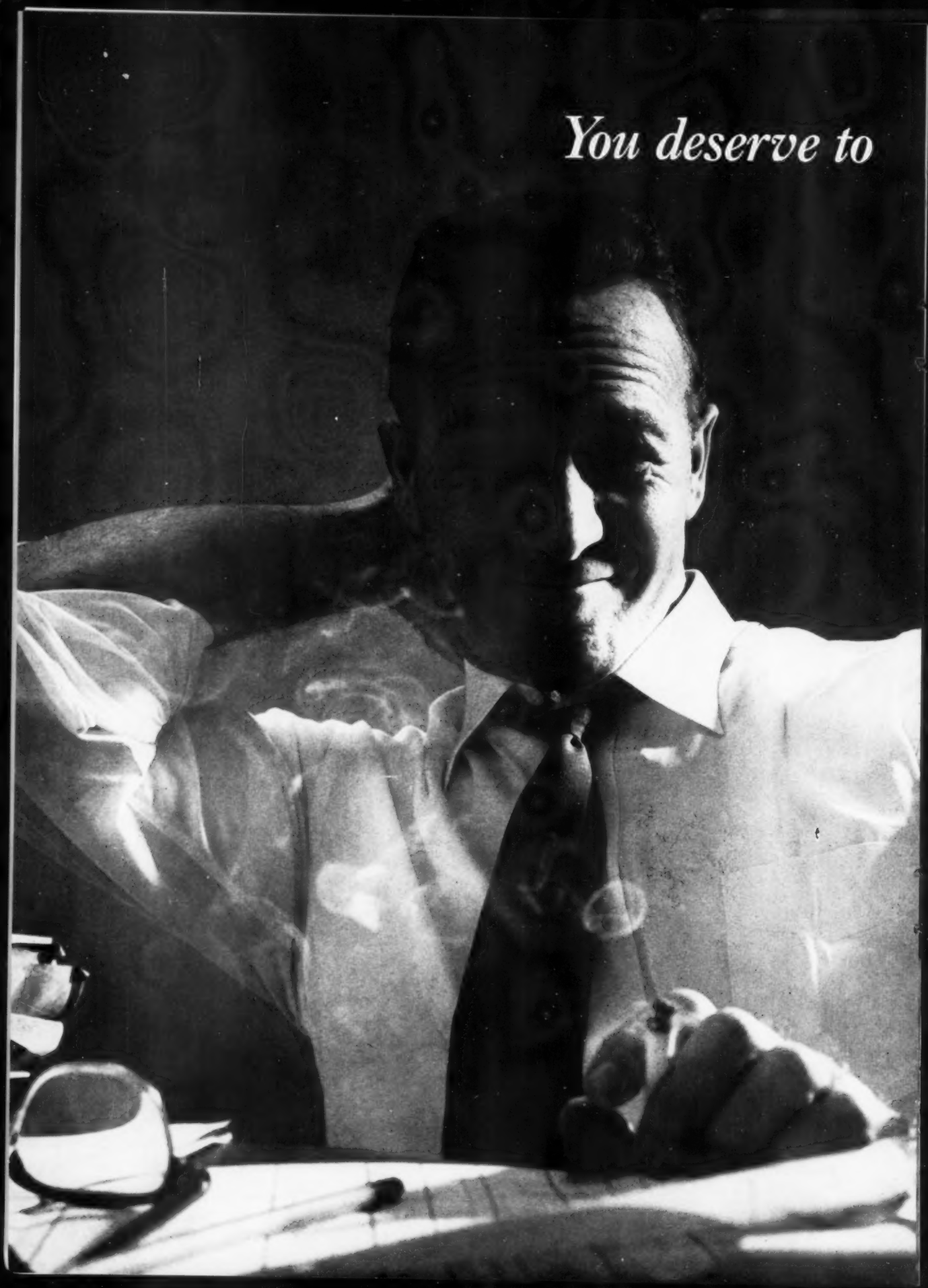
GENERAL ELECTRIC



FASTER INSTALLATION is possible with three-point keyhole mounting and new enclosure, with wrap-around cover and removable sides.



NEW FHP MANUAL STARTER has an exclusive plug-in overload relay heater and fits any standard wall box. Ask for Bulletin GEA-6388.


You deserve to

KNOW you've ordered the best

. . . and you have a right to be pleased with yourself when you do. Your own reputation rests on the kind of electrical equipment you order and the way you install it. And you can't afford to risk ordering and installing NOISY TRANSFORMERS...but are you?

You deserve the satisfaction of ***knowing*** you're giving your customers the best . . . the quietest, most efficient, most economical transformers available . . . ***when you make up your list of materials.*** And you can get the best ***without paying a premium*** by ordering and installing General Electric dry-type transformers.

HERE'S WHY: When you order G-E dry-type transformers for replacements or to meet the architect's specifications on a new project, you're not just ordering a necessary control device between the power source and the utilization equipment. Instead, you're ordering QUIET OPERATION. General Electric *Quiet* dry-type transformers are designed and built for maximum efficiency and reliable, long-life operation.

Why leave yourself open to transformer NOISE COMPLAINTS? Don't take the chance. Order and install General Electric *Quiet* dry-type transformers for the satisfaction of ***knowing*** you're getting the best. You'll find there's no "approved equal."

If there's a doubt in your mind, contact your local G-E Distributor or Apparatus Sales Office for more information. Or, send in the coupon below.

Always Order . . .

Quiet **G-E DRY-TYPE TRANSFORMERS**

GENERAL ELECTRIC

Send for this new bulletin before you order another transformer.

SECTION A411-5, GENERAL ELECTRIC CO.
SPECIALTY TRANSFORMER DEPT.
FORT WAYNE, INDIANA

Please send me the new bulletin "7 Guides for Selecting and Installing *Quiet* Dry-type Transformers," GED-3424, plus the new G-E Dry-type Transformers Buyers Guide, GED-6717, to help me order.

NAME ..... **TITLE** .....

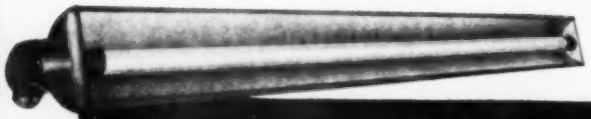
COMPANY .....

ADDRESS .....

CITY ..... **ZONE** ..... **STATE** .....

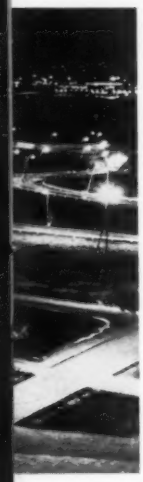
Name of your G-E Distributor .....

MERCURY Now available, 100- to 1000-watt mercury gives twice the light per watt, 2 to 6 times longer lamp life than filament. Economical for area lighting!



FLUORESCENT Fluoroflood fluorescent fixtures (used here for guide-sign lighting) now in 4-, 6-, or 8-foot lengths—for High Output or Power Groove lamps.

FILAMENT Available from 250 to 1500 watts, General Electric's complete line of filament floodlights includes a model just right for almost any application.



ONLY WITH GENERAL ELECTRIC OUTDOOR AREA FIXTURES CAN YOU CHOOSE FROM

ALL 3 LIGHT SOURCES

. . . AND GET THESE IMPORTANT BENEFITS

LOWEST COST CONSISTENT WITH HIGH QUALITY

Greater efficiency, more uniform light distribution, less maintenance, longer life—all mean savings for the user, now and later! General Electric premium-quality floodlights cost no more than ordinary floodlights! When you select General Electric floodlights, you can be certain you'll get the proper unit to do the job. Heavy-duty, general-purpose, or open units . . . fluorescent, mercury, or filament sources—General Electric has all the tools for your outdoor area lighting needs.

QUICK INSTALLATION, PRACTICALLY NO MAINTENANCE

Sturdily designed General Electric floodlights are quick and simple to mount, aim, connect, and maintain. The L-100, L-55, and L-80 series (filament and mercury) are equipped with threaded studs for 1½-inch conduit mounting; flat mounting bases are also available. The L-69A (filament and mercury) is mounted with galvanized-steel brackets, while the L-100 and L-55 units can be equipped with rugged cast aluminum supports. All parts are made of weather-resistant materials, and all floodlights are equipped with easy-to-read degree scales to facilitate aiming. Life of cable insulation and lamps is increased by cooler-operating General Electric floodlights.

MORE LIGHT PER UNIT, BETTER DISTRIBUTED LIGHT

As much as 35% more light—and more even light distribution—is provided by the exclusive "diamond-back" faceted reflector of General Electric's Type L-69A, L-100, and L-55 filament and mercury units. The optical design of the new Fluoroflood fluorescent fixture directs an optimum, uniform amount of light onto a surface, eliminating "hot spots" and dim areas. Large parking areas, highway guide signs, recreation facilities—whatever the application, modern General Electric outdoor area lighting fixtures do the job best.

AVAILABILITY FROM MANY DISTRIBUTORS' STOCKS

Coast-to-coast, more than 500 electrical distributors are franchised to supply General Electric floodlights from stock or by prompt shipment. Call in your distributor early on any floodlighting job. Besides application assistance, he can supply the complete lighting package—fixtures, lamps, cable, control, transformers, poles, etc.—to meet your needs.

Get all the facts on General Electric's complete line of mercury or filament floodlights, the Fluoroflood fixture, and the latest floodlight application practices. Just send in the coupon below, or contact your nearest General Electric floodlight distributor.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Section A451-198, General Electric Co., Schenectady 5, N. Y.
Please send me free information on the subjects checked below:

☐ Filament Floodlighting ☐ Mercury Floodlighting

☐ Fluoroflood Fluorescent Fixture ☐ Application manual, "How to Select and Apply Floodlights"

Name _____

Company _____

Street _____

City _____ State _____

NEW from the home of the RM transformer

G-E SEALED DRY TRANSFORMERS FEATURE . . .

Light weight, long life, wide application

Ideal for use in dusty, dirty, or otherwise contaminated atmospheres, General Electric sealed dry-type transformers are widely applicable throughout industry.

LIGHT WEIGHT

These G-E transformers are as much as 2000 pounds lighter than other sealed dry units, making it possible to install them virtually anywhere in your plant—even on balconies, catwalks, or other overhead platforms.

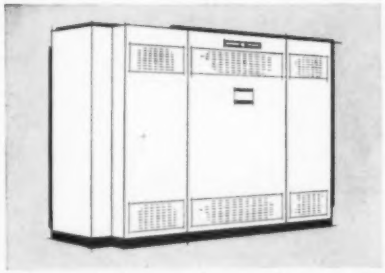
LONG LIFE

Long life and extra safety are built into these units by using such inorganic, noncombustible materials as G.E.'s new nonaging Alpholite insulation. These materials, plus sealed construction, add up to minimum maintenance.

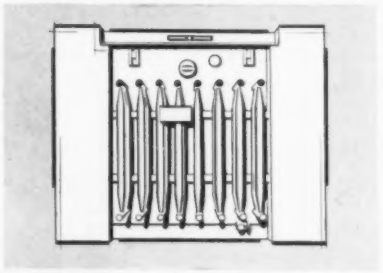
FULL INDUSTRIAL LINE

Regardless of your plant's operating conditions, there is an appropriate transformer in General Electric's complete line. Your G-E sales engineer can show you how you can save with faster shipment, easier installation, reduced maintenance, and longer transformer life. General Electric Co., Schenectady 5, N.Y. 417-1

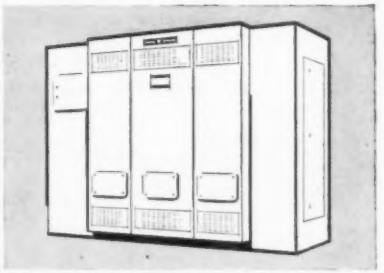
GENERAL ELECTRIC



OPEN DRY-TYPE transformers feature light weight, small space requirements.



LIQUID-FILLED transformers feature high impulse strength, broad application.

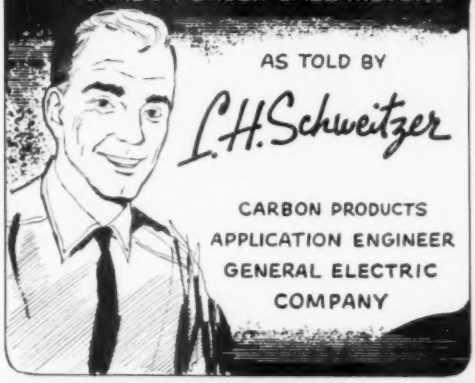


INTEGRAL DISTRIBUTION CENTERS are ideal "packages" for light power needs.

"How G-E carbon brushes helped . . .

STOP METAL TRANSFER"

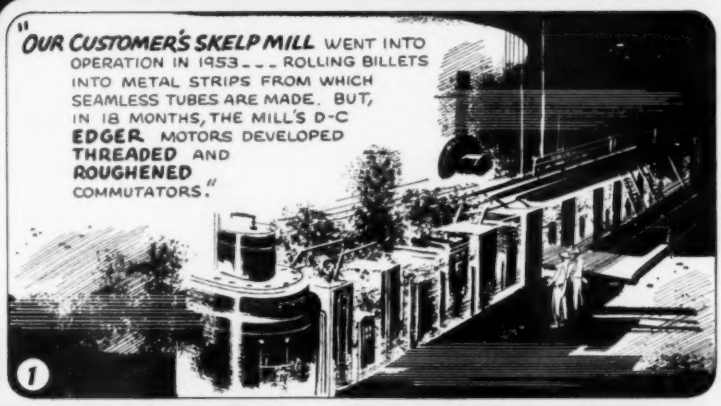
A GENERAL ELECTRIC CARBON BRUSH CASE HISTORY



AS TOLD BY

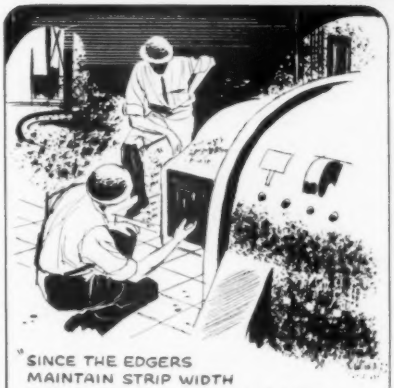
L. H. Schweitzer

CARBON PRODUCTS APPLICATION ENGINEER GENERAL ELECTRIC COMPANY



"OUR CUSTOMER'S SKELP MILL WENT INTO OPERATION IN 1953 - - - ROLLING BILLETS INTO METAL STRIPS FROM WHICH SEAMLESS TUBES ARE MADE. BUT, IN 18 MONTHS, THE MILL'S D-C **EDGER** MOTORS DEVELOPED **THREADED** AND **ROUGHENED** COMMUTATORS."

1



"SINCE THE EDGERS MAINTAIN STRIP WIDTH DURING ROLLING, CONTINUOUS PERFORMANCE WAS **IMPERATIVE**. WHEN THE MILL OPENED, A HIGH LEVEL OF MAINTENANCE WAS INITIATED BY THE CUSTOMER, AND OUR OWN ENGINEERS WERE CLOSELY FOLLOWING OPERATION OF OUR NEW ELECTRICAL EQUIPMENT."

2

"AS SOON AS TROUBLE WAS SPOTTED, AN ANALYSIS WAS MADE OF ALL VARIABLES AFFECTING THESE UNITS. **FINDINGS?** THE BRUSHES WERE SUBJECTED TO A HIGHER PERCENTAGE OF **LIGHT LOADS** THAN WAS ANTICIPATED. THIS SET UP CONDITIONS CONDUCIVE TO EXCESSIVE METAL TRANSFER AND POOR FORMATION OF A STABLE FILM ON THE COMMUTATOR."

3

"ABSENCE OF A PROTECTIVE FILM HASTENED THREADING AND ROUGHENING. SO A SPECIALLY DESIGNED GENERAL ELECTRIC BRUSH WAS RECOMMENDED, WHICH ENCOURAGED FORMATION OF A **STABLE FILM** UNDER THESE LOADS, THUS PREVENTING EXCESSIVE TRANSFER."

4

"**FAST FOLLOW-UP** AND A **COMPLETE LINE OF BRUSHES** FOR EVERY NEED SOLVED OUR CUSTOMER'S PROBLEM WITH **NO LOSS OF PRODUCTION!** CHECKS OVER THE NEXT TWO YEARS SHOWED THREADING AND ROUGHENING ELIMINATED."

5

SPECIFY GENERAL ELECTRIC CARBON BRUSHES FROM THIS COMPLETE LINE TO HELP GET TOP PERFORMANCE FROM **YOUR** G-E MOTORS AND GENERATORS. FOR HELP WITH YOUR BRUSH PROBLEMS USE COUPON OR CONTACT YOUR G-E APPARATUS SALES OFFICE OR DISTRIBUTOR. GENERAL ELECTRIC CO., SCHENECTADY 5, N.Y.

New bulletin offers answers to brush application and performance problems by one of industry's top authorities.

GENERAL ELECTRIC CO.
Section G774-5 • Schenectady 5, N.Y.

☐ Please send GEA-6688, "Better Carbon Brush Performance"

☐ Also, send GEA-5597, "G-E Carbon Brushes for Motors and Generators"

NAME.....

TITLE.....

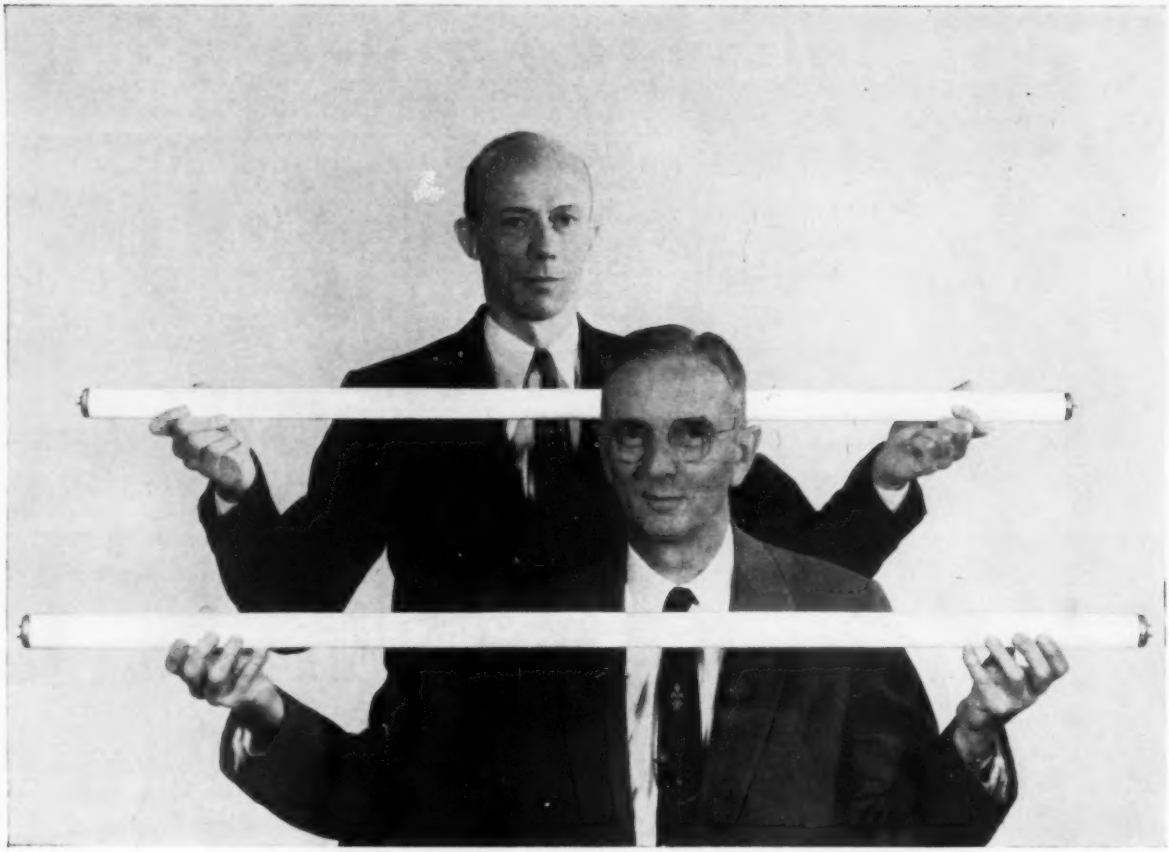
COMPANY.....

ADDRESS.....

CITY.....STATE.....

GENERAL ELECTRIC

GENERAL ELECTRIC'S 20th FLUORESCENT ANNIVERSARY ANNOUNCEMENT:



R. N. THAYER (left) AND G. E. INMAN developed first commercial fluorescent lamp in the U.S.A. in 1938. Still with General Electric, they have been key men in many G-E fluorescent lamp improvements.

Today's G-E Fluorescent Lamps give your customers 76% more light per watt, last 5 times longer...yet cost ½ as much!

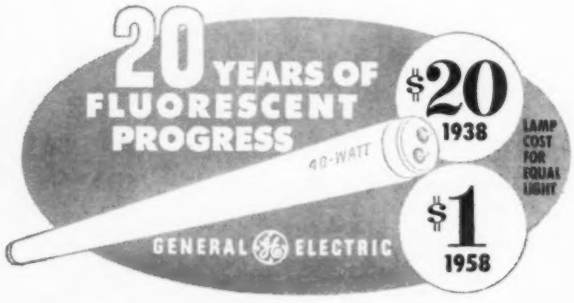
The first fluorescent, introduced 20 years ago this month by General Electric, can't hold a candle to today's G-E 40-watt Lamps. A steady stream of improvements from G.E. in Rapid Start and Pre-Heat Lamps has provided up-to-the-minute lighting systems for G-E Lamp users. Efficiency is up 76%, rated life is 5 times longer, and the list price is down 57%. *This means one G-E Fluorescent Lamp dollar today buys as much light as $20 did 20 years ago!*

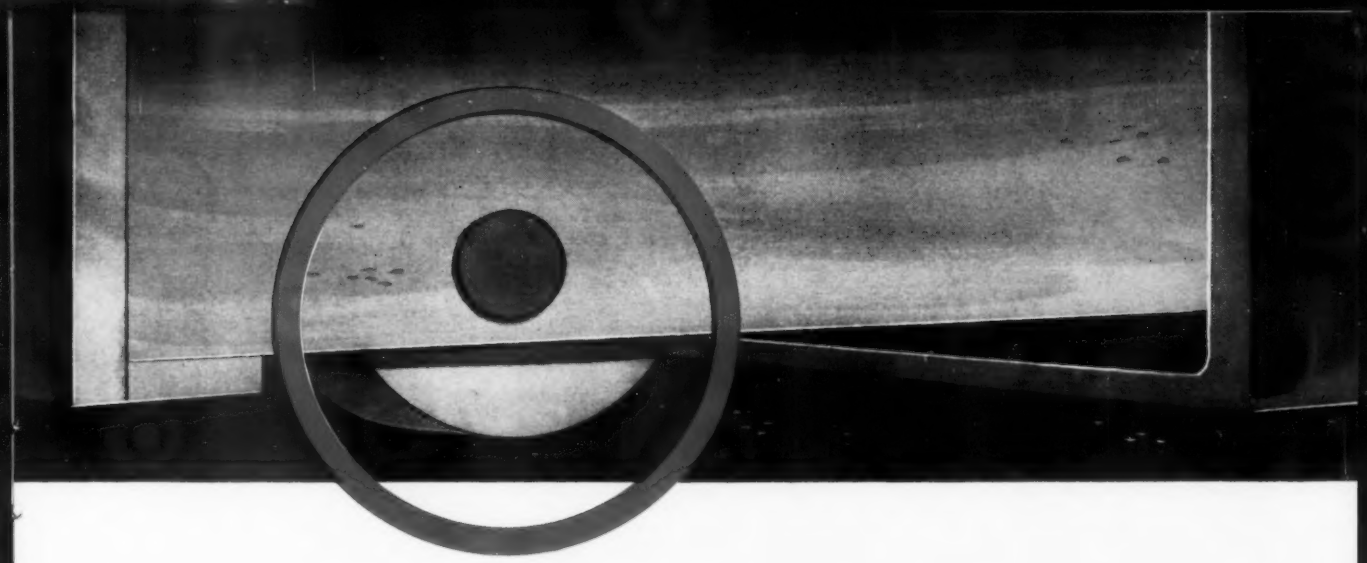
NEWEST IMPROVEMENT—"BONUS PHOSPHOR" This revolutionary new G-E process gives your customers 7 to 9% more light by selecting only the bigger, brighter phosphors to be used in G-E Lamps. It is another dollar-and-cents reason why they get more for all their lighting costs with General Electric Lamps.

This "Bonus Phosphor" is now available in the 40-watt and new Power-Groove—and will soon be used in all G-E fluorescent lamp types. For the whole "Bonus Phosphor" story—see or write your local General Electric Large Lamp Salesman.

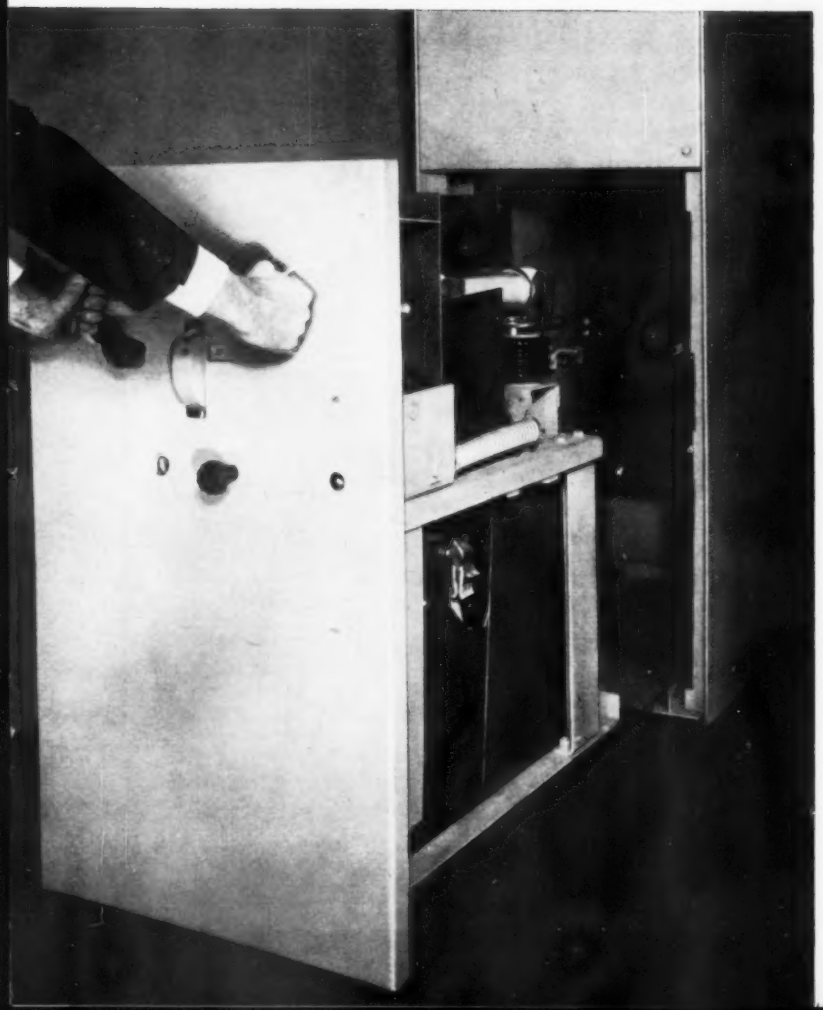
Progress Is Our Most Important Product

GENERAL ELECTRIC





Simple maintenance, inspection with General Electric ROLLOUT Switch and Fuse Equipment



It's new—General Electric Rollout Switch and Fuse Equipment. It rolls out like a file cabinet drawer—allows simple, fast inspection and maintenance. Plus—improved protection, greater safety, and installation flexibility.

For more information on this new Rollout Switch and Fuse Equipment call your nearest General Electric Apparatus Sales Office or write for bulletin GEA-6623, General Electric Company, Schenectady, New York.

514-2

Progress Is Our Most Important Product

GENERAL ELECTRIC

NEW ROLLOUT SWITCH AND FUSE EQUIPMENT, in ratings from 2.4 kv to 13.8 kv, is applicable for both normal switching and fault current protection.

Time-saving convenience. No waiting for short lengths to be cut off reels. Buy only what you need to finish up the job.

Quick, easy handling. You don't need a truck to pick up the wire you need. Just throw one of these cartons in the front seat of your car.

All-round protection. No matter where you use short lengths on the job, these convenient Rome cartons will protect your wire up to the minute it is strung.

Need short lengths of bare or weatherproof wire to finish up a job?

Pick them up in these handy Rome cartons

For your convenience, Rome bare and weatherproof wire, Triplex and Duplex SS cable—in short lengths—are packaged in handy cartons.

Don't lug a full reel onto the job when all you need is a short length to finish up the installation. Just ask your Rome distributor for the size you need in one of Rome's easy-to-handle cartons. 140

Type	Size	No. of Strands	Conductor	Covering	Length	Package	Packaging	Approx. Wgt. Lbs.
Bare	14	Solid	Copper	None	1000′	Spool	1 per carton	13
Bare	12	Solid	Copper	None	1000′	Spool	1 per carton	20
Bare	10	Solid	Copper	None	500′	Spool	1 per carton	16
Bare	8	Solid	Copper	None	500′	Spool	4 per carton	105
Bare	8	7	Copper	None	500′	Spool	4 per carton	105
Bare	6	Solid	Copper	None	300′	Spool	4 per carton	105
Bare	6	7	Copper	None	300′	Spool	4 per carton	105
Bare	4	Solid	Copper	None	200′	Spool	4 per carton	105
Bare	4	7	Copper	None	200′	Spool	4 per carton	105
Bare	2	7	Copper	None	250′	Coil	1 per carton	51
Weatherproof	14	Solid	Copper	Roprene	500′	Coil	1 per carton	10
Weatherproof	12	Solid	Copper	Roprene	500′	Coil	1 per carton	14
Weatherproof	10	Solid	Copper	Roprene	500′	Coil	1 per carton	20
Weatherproof	8	Solid	Copper	Roprene	500′	Coil	1 per carton	34
Weatherproof	6	Solid	Copper	Roprene	500′	Coil	1 per carton	51
Weatherproof	14	Solid	Copper	TK	500′	Coil	1 per carton	13
Weatherproof	12	Solid	Copper	TK	500′	Coil	1 per carton	17
Weatherproof	10	Solid	Copper	TK	500′	Coil	1 per carton	27
Weatherproof	8	Solid	Copper	TK	500′	Coil	1 per carton	36
Weatherproof	6	Solid	Copper	TK	500′	Coil	1 per carton	54
Triplex SS	6	Solid	Aluminum and ACSR	Roprene or Rolene	500′	Coil	1 per carton	80
Triplex SS	6	7			500′	Coil	1 per carton	80
Triplex SS	4	Solid	"	"	500′	Coil	1 per carton	110
Triplex SS	4	7	"	"	500′	Coil	1 per carton	110
Duplex SS	6	7	"	"	500′	Coil	1 per carton	50
Duplex SS	4	7	"	"	500′	Coil	1 per carton	75

• Save this ad and use it as a handy buying guide for Rome wire and cable in short lengths.

ROME CABLE
CORPORATION

SHALLORAMA®

the NATURAL choice in re-lighting

INCOMPARABLY SHALLOW • APPARENT DEPTH ONLY 2¼"

Designed for architects, interior decorators and building owners, the custom-styled SHALLORAMA® is a *natural* when it comes to re-lighting.

Here is a fixture combining clean, contemporary styling with basic simplicity and minimum maintenance. Easy to mount over existing outlets, these surface-mounted Visionaires® are so shallow in appearance they almost look recessed.

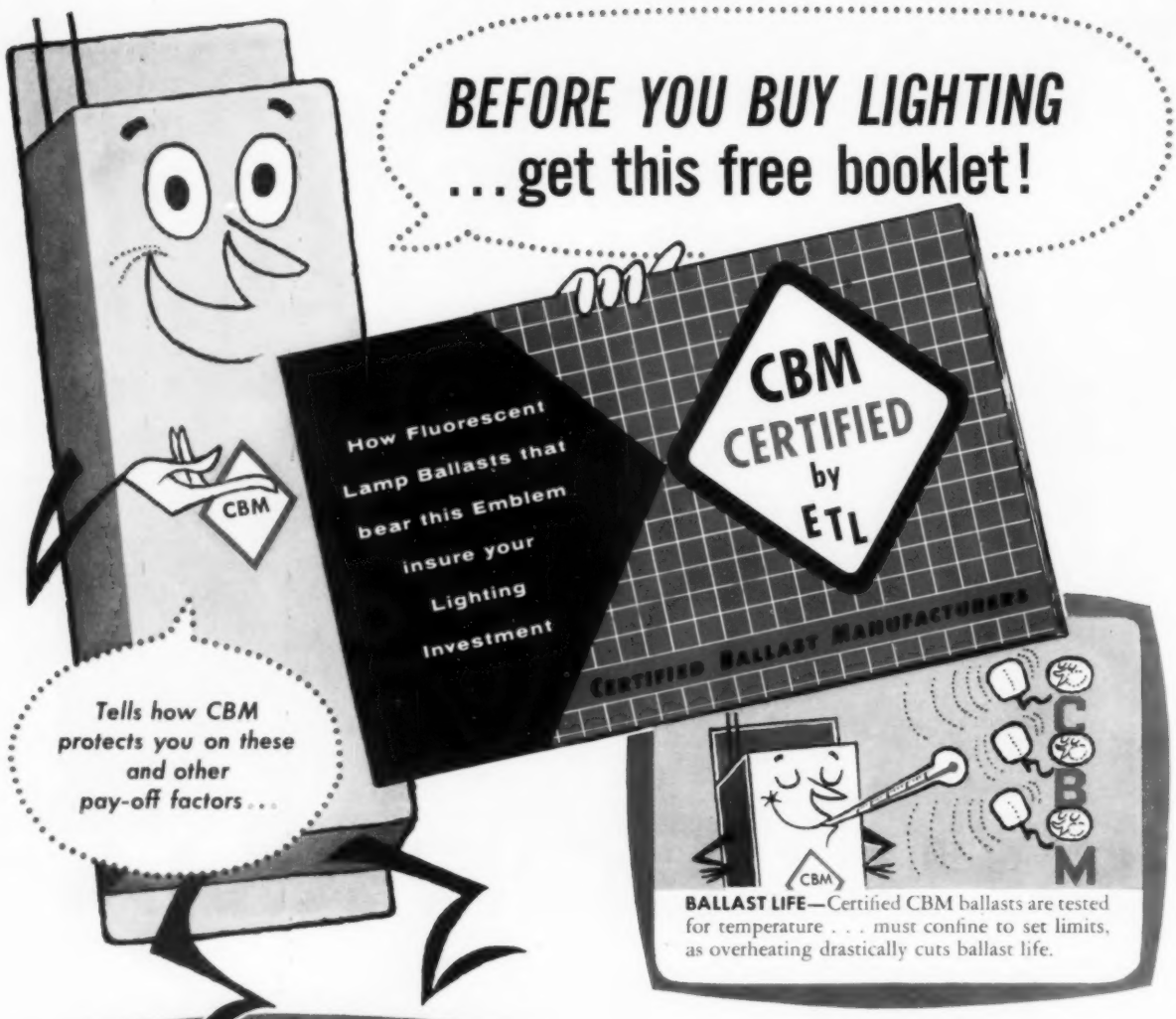
Available in 2 and 4 lamp widths, SHALLORAMA® is extremely versatile and suited for applications in offices, stores, banks, schools... especially in low ceiling installations. Re-light with Plexiglas shielded SHALLORAMA® for long-term serviceability.

SUNBEAM LIGHTING COMPANY
777 EAST 14TH PL., LOS ANGELES 21, CALIF.

SUNBEAM visionaire LIGHTING COMPANY

SUNBEAM LIGHTING COMPANY
3840 GEORGIA ST., GARY, INDIANA

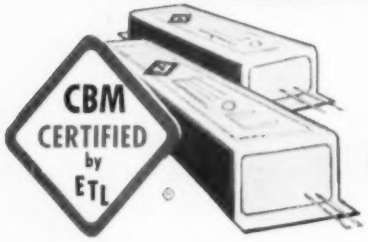
BEFORE YOU BUY LIGHTING ...get this free booklet!


How Fluorescent Lamp Ballasts that bear this Emblem insure your Lighting Investment
CBM CERTIFIED by ETL
CERTIFIED BALLAST MANUFACTURERS
CBM
Tells how CBM protects you on these and other pay-off factors...

BALLAST LIFE—Certified CBM ballasts are tested for temperature . . . must confine to set limits, as overheating drastically cuts ballast life.

QUIET OPERATION—CBM specifications require a ballast to be well-designed mechanically and electrically, so that it will operate quietly and not create objectionable noise.

RATED LIGHT OUTPUT—Certified CBM ballasts are "tailored to the tube" . . . assure rated light output, steady light, peak lighting performance.



Send for this free booklet and learn how these factors and 11 others help insure your lighting investment when you buy fixtures equipped with Certified CBM ballasts.

Eight leading manufacturers now make up the association of

CERTIFIED BALLAST MANUFACTURERS

2116 KEITH BUILDING • CLEVELAND 15, OHIO

Participation in CBM is open to any manufacturer who wishes to qualify

CBM-6-CE

ALL NEW!

WORK BULL 202 and DAVIS LOADER·BACKHOE

BEST POWER-MATCHED EQUIPMENT UTILITY COMPANIES CAN BUY!

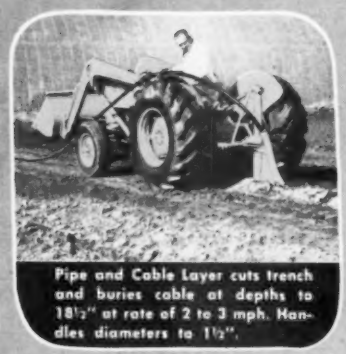
Here, at last, is a powerful industrial tractor, loader, and backhoe designed and integrated to each other. They work together as a single unit that is unsurpassed for lowering utility line construction and maintenance costs!

The all-new Work Bull 202 Tractor has low-silhouette styling, full-time power steering, dual-range, multi-speed transmission plus many other features to increase your on-the-job efficiency. High-torque 40 h. p. engine delivers more sure-footed lugging power at low speeds than any other tractor in the utility class.

Look how the Davis Loader is matched to the Work Bull. Tractor has built-in mounting to eliminate necessity for bumper. Assures easy installation and service – plus greater reach out front. Scarifier, Fork Lift, Landscape Bucket, Angle Dozer, and Crane attachments provide quick-change versatility.

The Davis Backhoe – the only machine in the world that can flush-dig alongside obstructions as well as handle normal digging assignments – features 10,000 pounds of breakaway and exclusive seat that swings with the boom so operator always faces his work. Five-minute detachability simplifies mounting Massey-Ferguson Power-Matched attachments such as the Cable Layer, Tipping Trailer, Cordwood Saw, Post Hole Digger, Side-Mounted Mower, Wagon Chassis, Auburn Trencher, and others.

Davis Backhoe on Work Bull 202 digs flush alongside obstructions, loads directly into trucks.



Pipe and Cable Layer cuts trench and buries cable at depths to 18½" at rate of 2 to 3 mph. Handles diameters to 1½".

Work Bull 202 and Auburn Trencher with hydraulic drive digs at speeds up to 600 feet per hour!

Get the Full Story on How to Save Manpower and Equipment Expenditures. Write for this free copy of the 28-page, fully illustrated brochure on the complete Work Bull and Davis Line. Ask for Brochure W-2.

MASSEY-HARRIS-FERGUSON, INC.

MASSEY-FERGUSON INDUSTRIAL DIVISION

1009 SOUTH WEST ST. • WICHITA 13N, KANSAS

NEW! and packed with profits!

the virden Sunshine® Ceiling

V-8046. Complete packaged ceiling $73.25 list. Slightly higher west of the Rockies.

A 4′ x 6′ "Packaged" Unit for Bathrooms, Kitchens For New Homes...Old Homes...Modernization

The new Virden Sunshine Ceiling.* A complete packaged unit that installs quickly and easily to any ceiling surface. Electrical channel system fastens to ceiling — satin white suspended grid holds plastic diffusers (8½″ drop). Uses six 100W incandescent lamps to flood the room with even, glare-free "sunshine". A sure-fire sales clincher in new homes. A terrific plus-profit maker for use in existing homes or on modernization jobs.

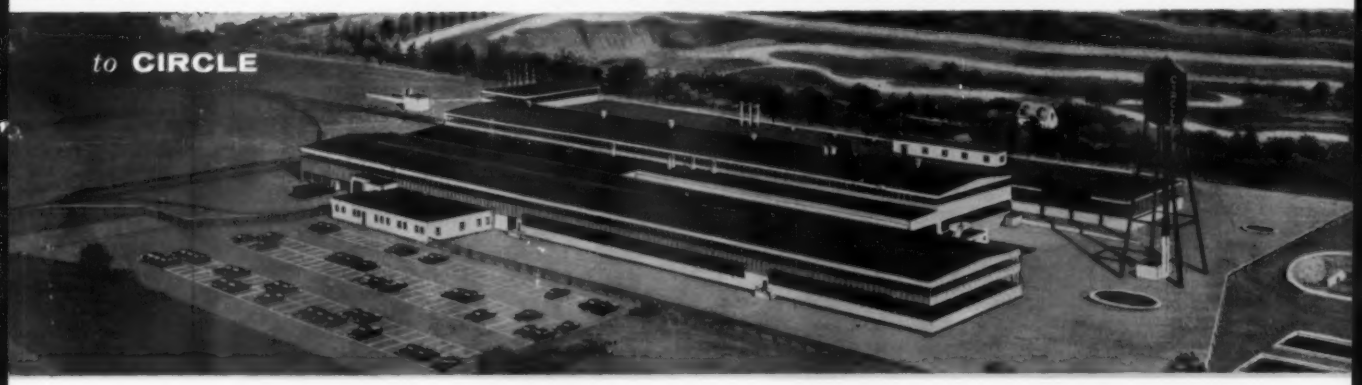
Luminous ceilings promise to be the next big development in home lighting. Virden brings it to you now in a complete easy-to-install package. Plan now to use it in your next job, new or old. See the model now on display at your Virden distributor, or write John C. Virden Co., Dept. ECM, 6103 Longfellow Ave., Cleveland 3, Ohio.

VIRDEN Lighting®

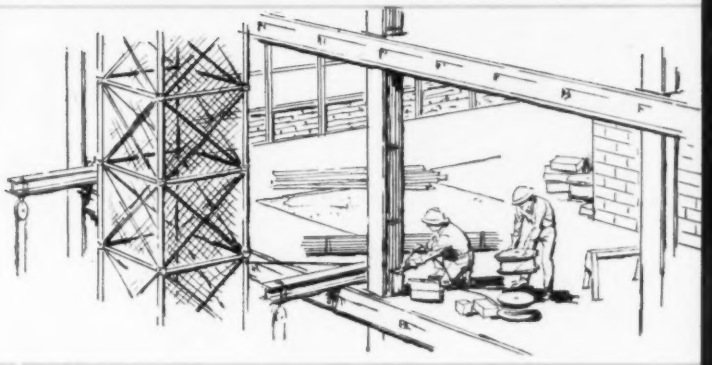
virden

Member American Home Lighting Institute

* Patent No. 2,659,807



to **YOU**



ONE SURE SOURCE OF SUPPLY

for all your wire and cable needs

This bird's eye view shows why working through a Circle distributor is your best assurance of quality products, ample stocks, and all-out service.

Take *quality!* It's assured because Circle controls every step in the manufacturing process – from the basic metals mined and refined by Circle's *own parent company,* Cerro de Pasco – down to the finished product.

Stocks? Circle's huge plants turn out over *a billion feet of wire and cable yearly* – enough to keep its many centrally-located warehouses fully stocked to meet all your wire and cable needs.

Service? Many contractors already know that Circle distributors get fast action with a simple telephone call – the result of a distributor policy that's out of sympathy with "red tape" and stuffed shirts.

Why don't *you* make a Circle distributor your "one sure source of supply." Many other satisfied customers do.

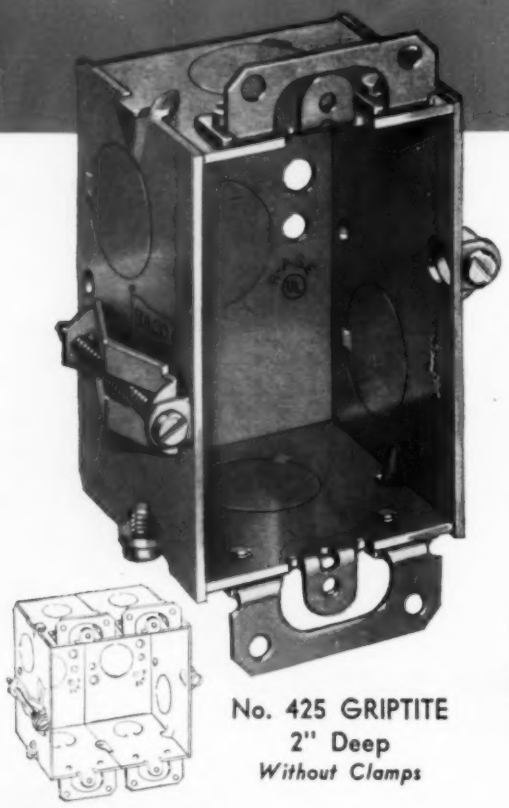
C W C **CIRCLE** **WIRE & CABLE**
a subsidiary of
CERRO DE PASCO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** in all principal cities

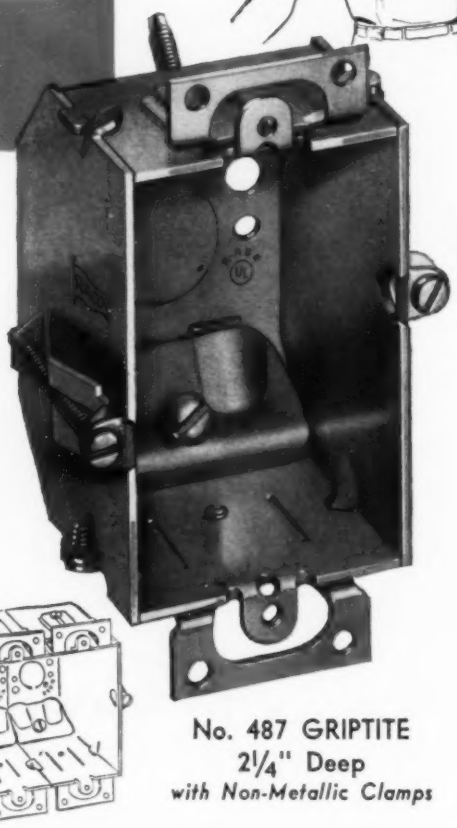
RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

Give Your "Old Work" A Profit Lift with

New RACO GANGABLE GRIPTITE BOXES



No. 425 GRIPTITE
2" Deep
Without Clamps



No. 487 GRIPTITE
2¼" Deep
with Non-Metallic Clamps

- GRIPTITES ARE EASIEST TO INSTALL
- WORK PERFECTLY IN ANY TYPE WALL—WOOD, WALLBOARD, PLASTER, CONCRETE, BRICK
- EXPANSION-ANCHORS FASTEN BOXES SECURELY
- 2-GANG GRIPTITES IDEAL FOR KITCHEN EXHAUST, CENTRAL AIR CONDITIONING SWITCHES

You Can Always Rely on Raco

You get fast installation with Raco gangable Griptite boxes. Make old work installations more profitable. Single or ganged, Raco Griptites anchor securely in any type of wall. Next time make a Raco Griptite installation and show a profit on old work!

ASE RACO **ALL-STEEL EQUIPMENT INC.**
AURORA, ILLINOIS

SLIPKNOT PLASTIC TAPE

solves the problem

there's waste and extra work in trying to tear plastic tape . . .
but not when you use the exclusive new SLIPKNOT Cutter, packed free*
SLIPKNOT
PLASTIC ELECTRICAL TAPE
with every 66' roll of new SLIPKNOT #7 Plastic Electrical Tape
Try it today.

*LIMITED TIME OFFER PAT. PENDING

SOLD ONLY THRU RECOGNIZED WHOLESALERS

PLYMOUTH RUBBER COMPANY, INC.

DIVISION 15 — Makers of SLIPKNOT FRICTION TAPE — CANTON, MASSACHUSETTS

2

great names combine

EMERSON pryne

to bring you the world's best in...

INDOOR VENTILATION

BEAUTIFULLY DESIGNED
easy to clean
VENTILATING
HOODS

keep kitchens sparkling clean and bright

HERE'S A REAL HOME-SELLING FEATURE—A kitchen ventilating fan-light-hood that's truly easy to clean—because it TILTS! Just press the finger-matic pushbuttons and the hood swings down so that all parts can be reached without stooping or straining. Fast, easy installation with no lost cabinet space. Competitively priced—these sales-winning hoods are available in all standard cabinet lengths and in finishes to compliment any decor.

FACTORY GUARANTEED FOR FIVE FULL YEARS

OUTDOOR AIR CIRCULATION

AIR CIRCULATING FANS

installed in patio or breezeway assure cool, insect-free comfort.

You can provide cool outdoor comfort in the modern manner with Emerson-Pryne ceiling-mounted air circulating fans. Made in 36" and 52" blade sizes with choice of reversible or non-reversible, 2 and 3 speed motors, to provide exact air circulation desired. Quick and easy to install in any porch, patio or breezeway ceiling. This is a customer-winning way to tailor-make air movement and enhance the enjoyment of insect-free outdoor living.

World's leader in / EXHAUST FANS · EXHAUST BLOWERS · ATTIC FANS · AIR CIRCULATORS
KITCHEN HOODS · CEILING HEATERS · RECESSED LIGHTING FIXTURES

EMERSON pryne COMPANY

POMONA, CALIF. · KEYSER, W. VA.
ST. LOUIS, MO. · TORONTO, CANADA

A DIVISION OF THE EMERSON ELECTRIC MFG. CO., ST. LOUIS, MO.

57TH YEAR APRIL • 1958

Electrical Construction and Maintenance

Lighting Break-through

Last month in Dearborn, Mich., Professor H. R. Blackwell, Director of the Vision Research Laboratories at the University of Michigan summarized and interpreted the results of a monumental eight-year research project on quantity of illumination for the IES. The research provides a new system for determining illumination levels which is expected to result in important changes in IES recommendations.

The basic research involved 56 practical visual tasks. The task brightness required to provide contrast values corresponding to a set of standard conditions (equivalent contrast), was determined. Task brightness in foot-lamberts divided by the reflectance gives the required illumination in footcandles.

The visual tasks selected for the study cover a very wide range from easy to most difficult. For the purpose of study by the technical committees of IES, they have been classified in five general levels of task difficulty. The number and variety of tasks measured makes it relatively easy to determine the required illumination for unrated tasks by comparison.

Interpretation of the research in terms of specific lighting recommendations will be the responsibility of the appropriate technical committees. However, the report gives clear scientific support to the need for much higher illumination standards than existing minimum recommendations provide.

It is evident that the reflectance of the task will be given much more consideration in determining footcandle levels. Where a combination or variety of tasks of various degrees of difficulty are encountered, the commonly used, most difficult will determine the lighting level which should be provided. In any location involving visual tasks, levels of less than 30 footcandles do not appear to be desirable.

Appraisal of the report will almost certainly result in doubling minimum footcandle recommendations for many lighting applications. It should also dispel any notions that present lighting practice is anywhere near optimum. For tasks rated difficult to most difficult, the test results show footcandle requirements substantially greater than the best of current practice and in some instances, values well beyond the capabilities of lighting systems as we know them today.

Wm. T. Stuart

4 NEW TIMESAVING TOOLS from Graybar

FOR ELECTRICAL CONSTRUCTION AND MAINTENANCE

***NEW*—Super Portable**

WELLS 49A
METAL CUTTING BAND SAW

Rigged with handle and ball bearing wheels, this new Wells 49A metal cutting band saw does double duty in the shop and on the job. As a horizontal cut-off tool it has a capacity of 3½" x 6". Swing the head and it becomes a vertical band saw. Call Graybar for details.

***NEW* Light weight, speedy**

CONDUMATIC BENDER

This new Condumatic motor driven conduit bender is powerful enough to handle rigid heavy wall conduit in sizes of ½", ¾" and 1". It's light enough to make it easy to move from job to job, or deck to deck. Makes 90° bends, offsets and doglegs right up close to the elbow. Ask Graybar for literature.

***NEW*—Back saving**

ALLEN ELEVATING SCAFFOLD

Make a crew out of one electrician with the new Allen Elevating Scaffold. Working platform regulates in heights of 4" and jacking device raises and holds heavy fixtures in place until securely fastened. Makes fixture hanging a fast, precise mechanical operation. Also, excellent for use in installing electrical duct or conduit systems. Have Graybar rush facts to you.

***NEW*—Shoot lines through conduit with**

JET LINE GUN—With the new Jet Line Gun you can shoot a line through conduit runs up to 250 feet, in seconds. Just load the Jet Line Gun with a CO_2 cartridge, line attached. Fire gun into conduit. Cartridge become projectile. Cartridge and line pop out open end of conduit. Pull heavier line in, then pull in wire. Call Graybar for demonstration.

Write for literature on all these new 1958 helps for electrical construction. They're typical of new electrical equipment you can expect from Graybar. If it's new, if it's extra good, if it's built by one of the country's leaders, Graybar has it for you. For immediate action—

85

CALL **GraybaR** FIRST FOR . . .

Graybar Everything Electrical Graybar Electric Company — Since 1869 — Reg. U.S. Pat. Off. — Quality

GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK

IN OVER 130 PRINCIPAL CITIES

Electrical Construction and Maintenance

Modern equipment, progressive methods of . . .

Motor Shops In New Orleans

Host to the 1958 convention of the National Industrial Service Association, New Orleans boasts a dynamic motor service industry serving a large, widespread market of commercial, industrial and marine electrical systems. Here's a look at activities in some of the NISA shops throughout the city.

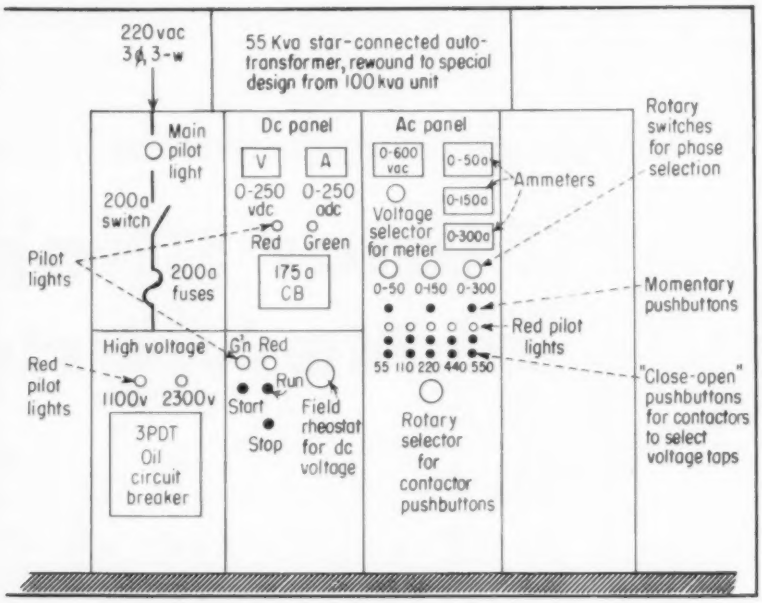
S. J. STEWART, dean of the motor service industry in New Orleans, here looks at a hand-held commutator undercutter powered from a flexible drive shaft connected to a ¼-hp, 120-volt motor on a 50-year old pedestal for a vibratory massage machine. This is one of the many interesting pieces of equipment in his two-story shop.

THOSE attending the 1958 NISA convention will find much of interest in the motor shops of New Orleans. Modern, automatic equipment is widely used; shop layouts are carefully engineered for production-line work flow; and novel methods and shop-constructed rigs are common in many of the shops. Marine work is a specialty with several shops which not only handle routine motor service work but also provide a contracting service for shipboard electric power installations. The mechanics handling this type of work are marine electricians—specialists in the use of bronze-armor lead cable and other types of wiring used aboard ships. And these men know the special installation methods and safety requirements for such work.

One of the most interesting shops is that operated by S. J. Stewart, president of the New Orleans chapter of NISA and acknowledged dean of the motor shop industry in that area. The large two-floor building houses office space, an old forge and a large second floor shop which includes a most unusual assortment of machines and equipment dating back many years. Among these are manual and automatic machines which Mr. Stewart built over the years to add speed, ease and efficiency to various phases of motor repair work. Everywhere in this shop, the skill and ingenuity of Mr. Stewart is fully in evidence. And this shop is actually the cradle of the motor service industry in New Orleans. A very large number of the outstanding motor shop operators in this city worked, at one time or another, in the Stewart shop.

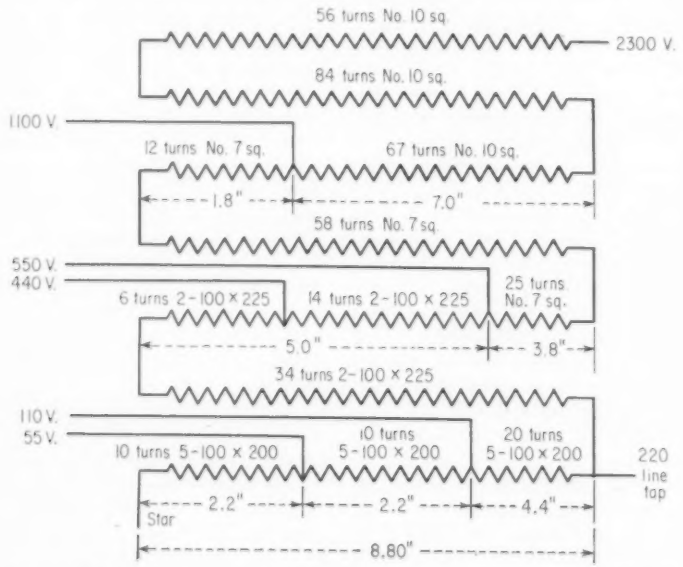
A wide variety of work is handled by the motor shops in and around New Orleans. This includes motor repair and rewinding, sales of new and rebuilt motors and transformer repair. Much of this work is represented in the round-up of motor shop activity on the following pages.

Versatile test board at Advance Electric Inc.



BARNEY OUFNAC, president of Advance Electric, here demonstrates how the voltage selector switch is used to select the required test voltage on the ac voltmeter—as the first step in a typical testing procedure for voltages from 55 to 550 volts ac. The components shown on the test board are indicated in the sketch at right.

Barney Oufnac heads things up at this shop where a specially engineered and shop-built test board provides full, fast and effective testing on any repair job. This board, which takes up very little floor space in the shop, is a compact package of floor-standing compartments with assorted controls and meters on its dead front. The board can be used for ac testing up to 2300 volts and dc testing up to 250 volts. Together, the accompanying photo and diagrams tell the story on application of this outstanding motor test board.



WINDING DATA on one phase of star-connected autotransformer which is heart of ac section of test board.

Basically, the board is divided into three distinct sections—(1) the incoming supply section, (2) the ac test voltage section, and (3) the dc test voltage section. Internally the board contains switches, magnetic contactors, circuit breakers, fuses and pilot devices. An integral part of ac operation of the board is a special autotransformer on top of the compartments. A motor generator set supplies the dc section of the board. And output from the board is carried to loads under test by three sets of test leads: one set for dc, one set for ac voltages from 55 to 550 volts and one set for 1100 and 2300 volts ac.

Power supply to the test board is made by a 220-volt, 3-phase, 3-wire, 60-cycle line in conduit which enters the top left part of the board. This supply is tied into a 3-pole, pressure type fused switch. From the secondary of this switch, power can be supplied directly to the ac output bus at 220 volts, 3-phase, when this is required. For other ac voltages, a line from the secondary of the main switch is carried to the primary phase windings of the autotransformer on top. Connection is made to taps suitably

placed on these windings to provide voltages of 55, 110, 440, 550, 1100 and 2300 volts from other taps on the windings. These other voltages are derived directly from the autotransformer and, with the exception of the 1100- and 2300-volt taps, are connected to the output bus through a hookup of magnetic contactors in the ac section of the board.

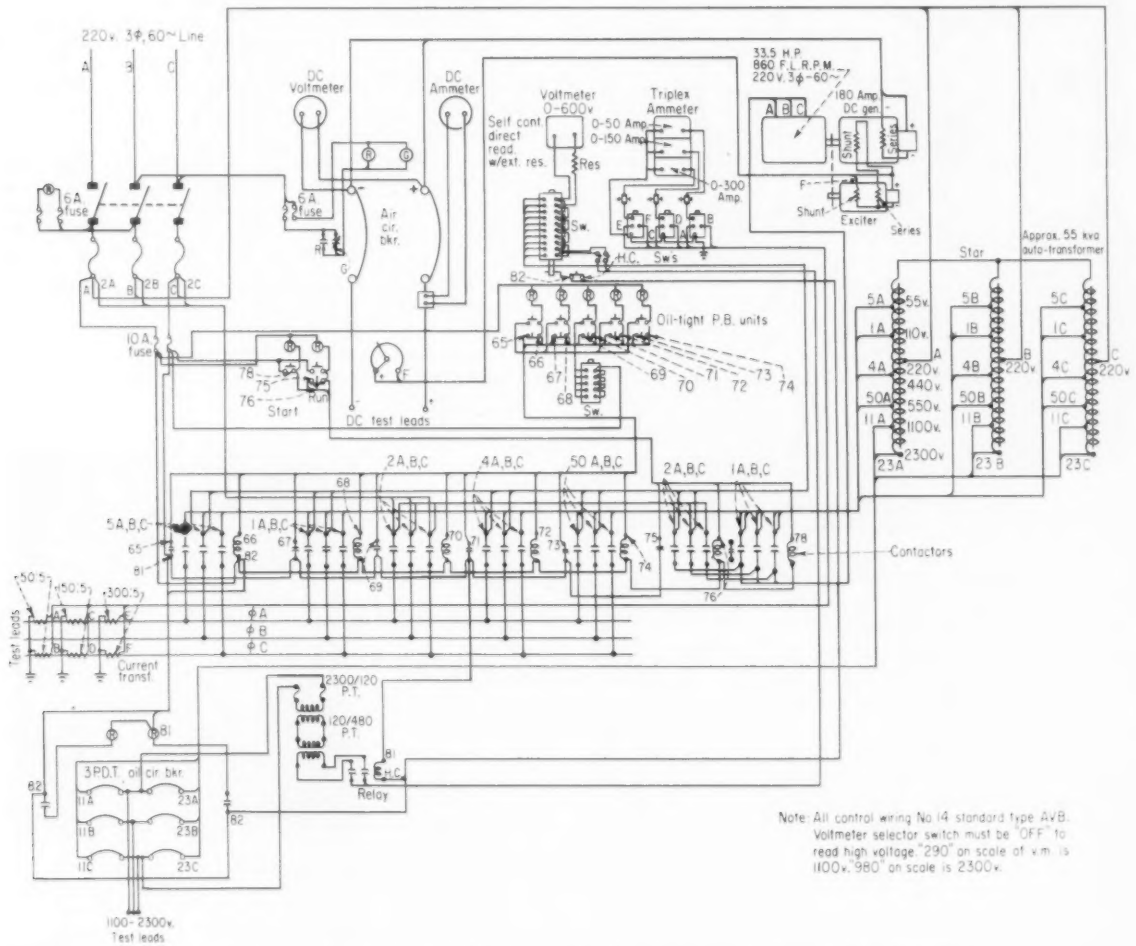
For testing at 1100 volts or 2300 volts, a 3-pole, double-throw oil circuit breaker is thrown into the indicated position for the voltage desired. A step-down transformer arrangement is used to tie these high voltage outputs into the 0-600 voltmeter. The meter scale is calibrated to indicate these voltages.

The star-connected autotransformer which provides the range of ac voltages was designed and built in the shop. It is rated at approximately 55 kva and is mounted in a ventilated enclosure. Selection of any of these ac test voltages is first made on the ac voltmeter by means of a rotary voltage selector switch. Then, with the low voltage ac test leads connected to the motor under test, the "close" pushbutton for that voltage is pressed to operate the contactor which connects the voltage from the autotransformer taps to the ac output bus. The motor under test is thereby energized.

Three ammeters are mounted on the ac panel of the board—0-50 amps, 0-150 amps and 0-300 amps. When a motor is under test, supplied with the proper voltage from the board, the current in each phase is read from one of the meters, depending upon the size of the motor. A phase selector switch for each of the three ammeters provides for connection of each phase of the output to the ammeter. For instance, phase A can be set on the selector switch for the appropriate ammeter. Then a spring-return momentary pushbutton for that meter is pressed to close the meter circuit to get the reading. Then the next phase is selected and the same button pressed to get the reading. And then the third phase is measured in the same way. With this arrangement, all conditions of test are fulfilled before connecting in the meter.

For dc testing, a 180-amp, 250-volt, dc generator is connected into the test board and to the dc output test leads. Control is provided as shown in the diagram. The M-G set is mounted behind test board.

All of the other top men at Advance have made contributions to this board, including Willet Falcon, shop foreman, Eldon Des Roches, engineer, and Joseph Pregeant.



Note: All control wiring No. 14 standard type AVB. Voltmeter selector switch must be "OFF" to read high voltage. "290" on scale of v.m. is 1100v. "980" on scale is 2300v.

WIRING DIAGRAM of this outstanding test board shows complete circuiting of ac sections and the dc section.

GIANT DIP TANK is constructed of ⅜-in. plate steel and completely reinforced on all sides by 4-in. flat and angle iron beams. The top of the tank, shown here in the closed position, is lifted by a one-ton chain hoist. Other hoists lift large basket from tank. Tank sets into concrete floor. Construction of sides, ends and bottom is same as that of top. Welded construction is used throughout.

OPEN TANK reveals large capacity of dip work which can be handled. Lift hook on basket can be seen at both ends of tank. Note seal groove around under side of tank cover. This fits lip on tank to assure air-tight seal for vacuum impregnation.

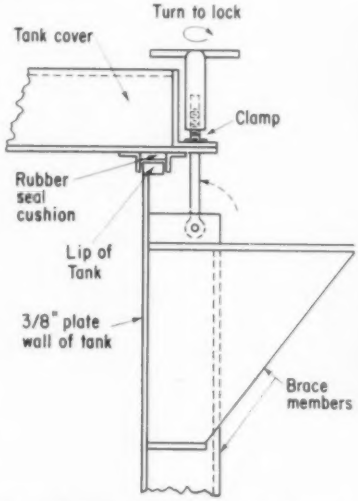
Giant dip tank at New Orleans Armature Works

This shop is one of the largest motor repair shops in the Gulf south area. And a giant varnish dip tank which was completely designed and constructed in this shop gives some clue to the volume and type of business handled here. Charles Hiers is the president and guiding light of this modern motor service company.

The giant varnish dip tank is fabricated of ⅜-in. plate steel and sturdily braced by angle iron members. A total of over 8000 lbs of steel were used in the construction of this tank. The overall tank is 11 ft long, 6 ft wide and 6 ft, 6 ins. deep. The tank is set in the concrete floor of the shop to a depth of over 5 ft. Only a small part of the tank protrudes above the floor level, minimizing obstruction to sight and movement of equipment by chain hoist. And the low level of the tank top greatly simplifies the task of lifting and loading equipment into the tank.

As shown in the photos, the hinged top of the tank is opened and closed by means of a one-ton chain hoist suspended from a steel beam above the back edge of the tank. To provide for vacuum impregnation of varnish, the tank is equipped with pipe connection to the shop compressor, and the top of the tank has a tight air seal around its edge. All around the perimeter of the tank top, clamps are provided to lock the top tightly in the closed position. Construction details of the tank top seal are shown in an accompanying sketch.

In use, the tank provides many and obvious advantages. At present it is filled half way by about 1800 gals. of varnish. A very large volume of varnish dip work can be handled at one time with this tank. A large basket, with cross section equal to that of the inside of the tank, is used to hold equipment in the varnish. This basket is sturdily constructed of angle and channel iron and is normally left in the tank. When the tray is to be loaded with work, two 1-ton chain hoists (one at each end) are used to lift the basket up to the top of the tank. Then when the basket is loaded, the hoists lower it into the bottom of the tank. The two hoists for the basket are suspended from steel booms at the ends of the tank.



CLAMP AND SEAL details for tank cover are shown in this sketch.

BILL HOLZBERG, coil foreman at N. O. Armature, tightens cover clamps preparatory to vacuum impregnation of tank load. Pipe at Bill's right is connected to shop compressor. Clamps are spaced around edge of tank.

Switchboard work at Industrial Electric Inc.

This large and active motor service company handles a constant volume of standard motor and transformer rewinding and repair work. And the modern, airy shop is well equipped for all such work. But a very important and continuing business here is the custom design and fabrication of special switchboards for use with diesel-electric generating plants.

An accompanying photo and caption describe a typical generator switchboard. These are used with generating plants out in the oil fields and aboard drilling platforms used for off-shore oil well operations. Switchboards have been constructed for oil drilling in the Gulf of Mexico and for various South American operations.

In general, these boards provide control and metering equipment for the generators, protection and switching for internal subdivision of the generator input and control and protection for outgoing feeder and branch circuits to external loads or distribution equipment. Of course, the exact design and layout for any board will depend upon the specs submitted and the type of loads to be served. For multiple generator operation, either a synchroscope or a synchronizing hookup of incandescent lamps may be installed to bring the generators onto the bus in synchronism.

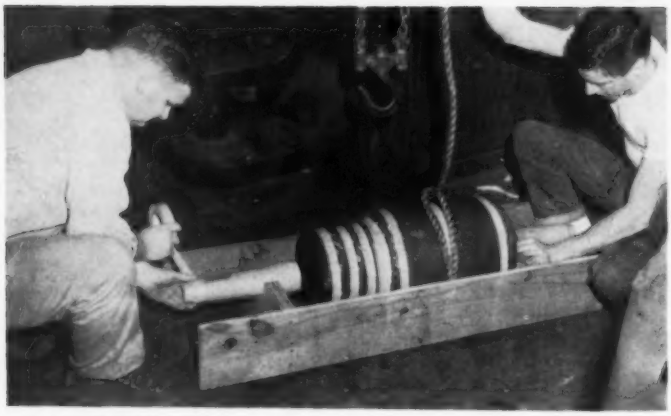
In a typical switchboard job, the necessary components are selected to fulfill the design. Then a suitable overall enclosure is constructed, and the components mounted and wired in the various sections. The enclosure is then given a finishing protective coat of paint to enable it to withstand atmospheric conditions.

GENERATOR SWITCHBOARD (overall view) is made up of three sections: (1) switching, protection and metering of one of the generator supplies to the board at left, (2) the same arrangement for a second generator in the center section, and (3) the output distribution section. Generator lines will come into the first and second sections from the back and connect to the three lugs on top of the main CB's. One of the CB's is shown at the bottom of the left section. From each CB, the line is carried up and through a disconnecting knife switch to the main switchboard bus. The two generator supplies are paralled on this bus. The disconnects provide isolation of each generator supply section from the common bus for maintenance or for single generator operation. Circuit breaker panelboard at right is fed by main bus from two supply sections. Panelboard supplies power and light branch circuits. Below panel, a 2-hp and a 7.5-hp motor starter are mounted on the enclosure and supplied from CB's in the panel. At the job site, the load circuits are then wired into the branch CB's and the motor starters. This board is designed for two 275-kw, 220-volt, 3-phase generators and is equipped with meters, a governor for speed of diesel drive, a voltage regulator and a synchronizing switch which is used in conjunction with incandescent lamps to bring the two generators into synchronism. The sockets for these synchronizing lamps are shown just above the head of the man at left. Joseph Darcangelo, at right, is the shop foreman on fabrication and trouble-shooting.

Exchange sales at Mississippi Valley Electric

Marine motor service is a specialty in this large, modern motor shop near the waterfront in downtown New Orleans. Here, business operations vary somewhat from a strictly industrial type shop in order to meet the special requirements of marine customers. A typical example of such special operation is the equipment exchange program which was started and developed to better serve the large shipping industry in this port city.

The equipment exchange program is geared to the motor service needs of ships. In servicing ship motors, time is very important. A ship pulls into port and normally stays only long enough to unload and reload. A ship must keep moving to make money. If any motors on a ship are defective in any way, they must be repaired as quickly as possible to prevent overtime stay of the ship in the port. Now if a ship requires motor rewind work during a port call, the



REBUILT ARMATURE for a 50-hp, 230-volt, dc, 600 rpm motor for a cargo winch is here given the final packaging touch after being completely overhauled. This was received as a defective unit, stripped, cleaned, checked for shaft and core defects, repaired and then rewound. Vacuum drying and varnish impregnating is used to assure high insulation readings even after long periods of storage. Baking of the armature is done with the shaft vertical. The finished armature is wrapped in a waterproof, preservative paper, tightly sealed with tape. The shaft ends are wrapped with cotton tape. To prevent rust on the shaft, the cotton wrapping is then saturated with oil. The unit is shown here resting in a half-crate cradle. Another similar half crate is placed on top of the unit. The cased armature is then put into the storage section. Shelf life of armatures varies, but the processing must prevent deterioration of insulation over periods as long as two years or even longer.

job will require overtime work in the motor shop, will be very expensive to the ship owner and may tie the ship up for an overtime stay.

Facing the above problem, F. L. Pendergrass and his son Jim, owners of the Mississippi Valley shop, decided to organize for this market. They decided to stock as wide a range as possible of armatures for motors used aboard ships. Then when a shipboard motor needed rewinding, they could quickly provide and install a rebuilt armature, take the defective armature in exchange, rebuild the old armature at straight time and then return it to stock. In this way, shipboard motor work would not delay the ship, the cost of motor work would be lower. All around, this program solves a very big problem for the ship owners. But, with the initiation of the exchange sales program, the work really just began for the shop.

Success of the exchange program depended at first on building the stock of rebuilt armatures. Because all types, ages and sizes of ships of varying national origin come to this port, it was a tough job to acquire a representative stock of "common" types of armatures. But over a period of hunting high and low among old equipment dealers, the stock was slowly built up. Of course, it is still a continuing job to acquire types of armatures they do not yet have in stock. And to maintain the program intact, stock armatures are sold only on an exchange basis—they must get an old one for the rebuilt one. In general, only one of each type is kept in stock. Extra rebuilt units are frequently sold to customers as spares.

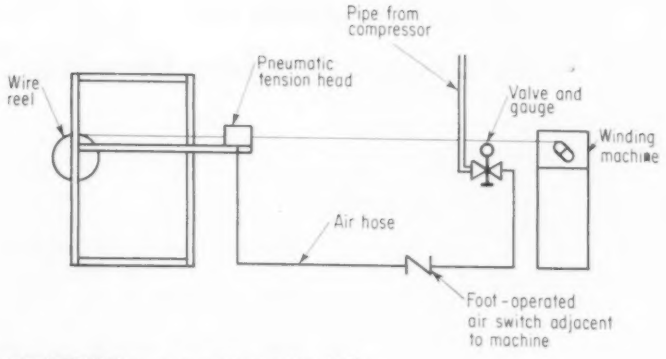
To assure effective operation of this program, the purchase and stock of necessary repair materials is closely related to the rebuilding work. For instance, factory coils are kept in stock for the highly repetitive types of rebuild work. And a stock of coils to customers' specs is also maintained for special rewind work.

Accompanying photo shows typical rebuilt armature being prepared for stock.

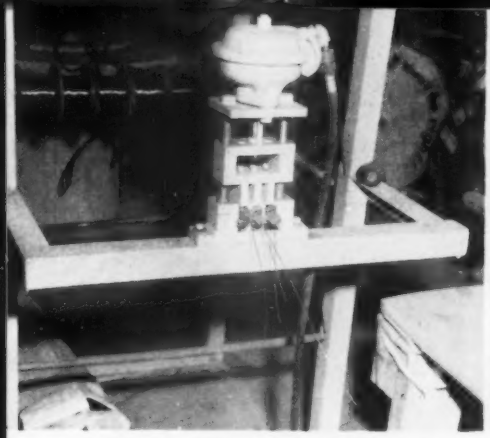
Pneumatic tension device at Gulf Electric Inc.

Modern, automatic equipment for coil-winding and other operations is a feature of this shop which handles marine and other motor service work. Typical of the equipment used here is the pneumatic tension adjuster used for coil winding.

As shown in accompanying illustrations, an air hose is connected to the tension head device mounted on the rack which supports the wire reel. This air hose is supplied, through a valve, from a connection to a pipe line from the shop compressor. The valve, which is tapped



AIR HOOKUP for pneumatic tension device.

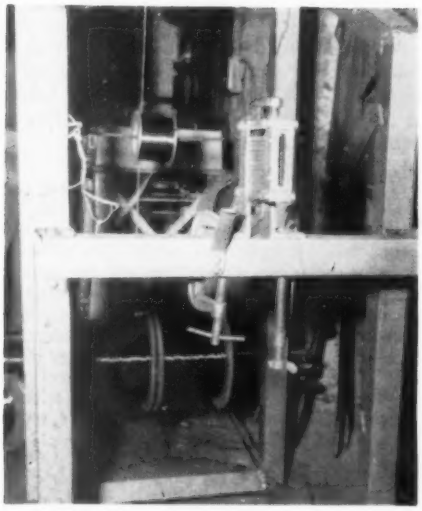


PNEUMATIC TENSION BLOCK (left) is mounted on rack which holds wire spools and has air hose connection to operating unit at top. At right, Fabian Fink, assistant manager of the Gulf Electric shop, holds right hand on coil winding rig while operating the foot pedal air switch in the hose to the tension block. The pipe from the compressor is shown coming down to valve with gage on side of winding machine.

by a pressure gage, is used to set the air pressure in the line to provide tension at the block in accordance with wire size and coil size. An air switch which is operated by a foot pedal is connected in the air hose to the tension block. The operator winding coils uses this pedal to actuate the tension and has both hands free for the winding job.

Use of this pneumatic block arrangement provides uniform, proper tension on all turns of a coil as well as on a series of, say, 20 to 30 coils for a winding. Compact winding assures ease of inserting in coil slots and proper utilization of space in the stator.

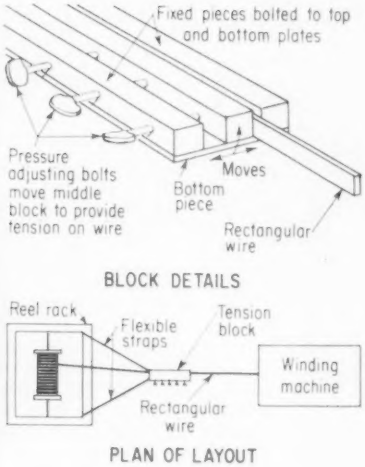
Tension blocks at Best Electric Co.



Two shop-built tension devices used for coil winding operations are interesting items in this large shop. As shown in photos, one of these blocks is used for circular wires, and the other is used for heavy, rectangular wires used in large form wound coils.

The Best Electric shop is operated by E. A. Schlessinger, Jr. The shop foreman is Charles Kenney.

TENSION BLOCK for winding wires of circular cross section consists of small pieces of flat steel bars bolted in a frame of one top piece, one bottom piece and two vertical members on each side. Within the open sided box formed by these pieces, a stack of fiber pieces—each equal in cross section to the inside cross section of the frame—are piled. Two bolts which come through threaded holes in the top piece provide pressure on top of the stack of fiber pieces. The block is clamped to a cross piece on the large rack shown, with the wire reel on a bar at the back of the rack. Wire from the reel is fed through the block between fiber pieces at a suitable level in the stack and carried to the winding head. Then for the conditions of the particular job, the two pressure bolts are adjusted for proper pressure in the fiber stack.

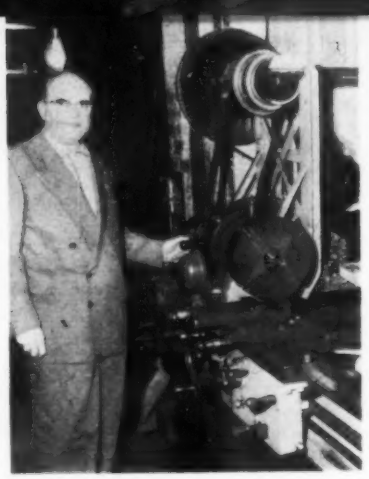


RECTANGULAR WIRES for form-wound coils are maintained in proper tension by the device shown here in the hands of Charles Kenny, shop foreman. The device is tied, at its back end, to two steel bands which run back to the rack on which the wire supply is mounted. The wire is fed through the center of this block and carried to the coil winder, out of sight in photo. Diagram at right shows the tension block with top cover removed, indicates method of clamping for proper tension. Plan view shows layout of equipment when block is used.

Machinery at Atlas Electric Co.

Atlas Electric operates a full scale repair station for Westinghouse and Otis elevators. This includes all types of motor and control service, rewinding, etc. This well equipped shop also handles regular industrial and commercial motor repair work.

Heavy machinery for all types of metal working and fabrication is a feature of the Atlas shop. Dan Duvoisin, owner of Atlas Electric, is shown in the accompanying photo standing beside a 16-in. lathe in his shop. This lathe is equipped with a reversing switch of the type used in elevator cabs. This switch is connected in the coil circuits of a reversing type magnetic starter operating the lathe motor. With this hookup, the rotation of the lathe can be quickly reversed in direction as various types of repair work may require.



DAN DUVOISIN who keeps close tabs on the operations of his motor service shop here demonstrates a reversing feature he added to the shop's 16-in. lathe.

Shop equipment at Ship's Electric Service

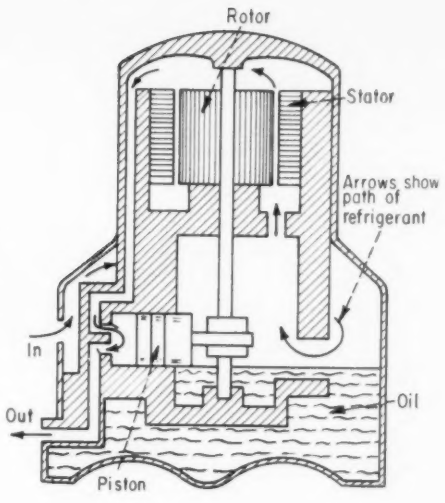
Here is another shop that handles primarily marine motor work. About 90% of their business involves shipboard electrification, electrical maintenance and complete motor repair. Marine wiremen work out of this shop which has a very large stock of bronze-armor, lead cable. This cable is used for shipboard power circuits and extensive control wiring.

CABLE REELER on which a 40-in. reel of bronze-armor, lead cable is resting consists of a welded angle-iron frame with two 5-in. diameter rollers bridged between ball bearing holders on opposite sides of the frame. Bearing mounts are bolted to frame. Rollers are lengths of 5-in. pipe with ends welded closed, flanges welded on near the ends and a 1-in. dia. shaft run through each roller and held in the bearing mounts. Flanges keep reel on rollers. The small wheel mounted on the frame between the bearing mounts keeps the reel from sliding against the flange stops. An inclined steel platform is used for rolling the reel into position. With this device, unreeling of this large, heavy cable is a relatively simple job.

Ideas from Bill Dreis Inc.

This shop specializes in fractional hp motors for tools and appliances. Under the able management of Bill Dreis, the shop handles all phases of motor repair and rewinding. In addition, this shop is the authorized repair shop for a number of name brand power tools.

POWERED LIFTWAGON is one piece of equipment which gets almost continuous use around this shop. The hydraulic lifter can raise 700 lbs to a height of 54 in. This provides quick and easy loading and unloading of equipment, into and out of trucks. It finds wide general use for lifting equipment and moving it about the shop. With it one man can do the work of three. In this photo, it is being used to transport an emergency light and power plant.

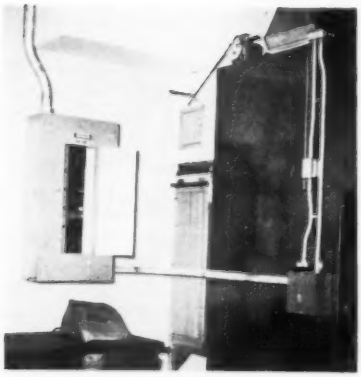


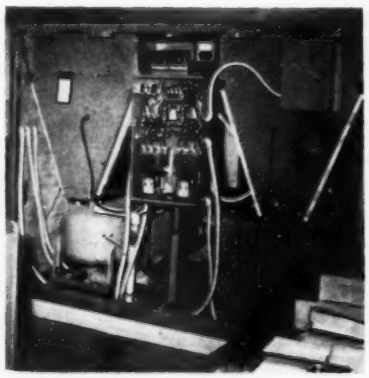
HERMETIC MOTOR is completely sealed within compressor housing. Cool refrigerant is directed through motor windings in its path through compressor, as shown by arrows.

Air Conditioning Wiring ... and the National Electrical Code

An up-to-the-minute analysis of current practices in the wiring and protection of circuits and components used with today's air conditioning equipment.

By W. J. Novak





PACKAGED WATER-COOLED CONDITIONER with front panels removed (right) uses two 10-ton hermetic compressors and a single blower located in the plenum above. Magnetic starters for all three motors are mounted in control cabinet in center of photo; control circuit fuses are mounted in covered box in upper right-hand corner. The three flexible metallic conduit connections on left side panel of unit carry motor branch-circuit conductors into conduit outside of unit and to circuit-breaker panelboard shown in left-hand photo.

THREE principal factors create problems of circuit design in air conditioning wiring which are not normally encountered with other utilization equipment: (1) Extensive use of hermetic compressors and associated equipment has made inapplicable the horsepower-current relationships identified with conventional motors. (2) Most equipment incorporates two or more motors, creating problems of group protection. (3) The air conditioner exists in several forms which alternately identify it as an appliance and as a straight motor load, making consistent and direct application of present National Electrical Code provisions difficult.

The main objective of any air conditioning installation is to provide maximum reliability and effec-

tiveness of operation, consistent with economy and applicable safety codes. The electrical engineer, contractor and inspector, to do their part in accomplishing this objective, must see eye-to-eye in the installation of the equipment furnished and its compliance with the code.

Fundamentally, the circuiting of every air conditioning installation involves consideration of each of the following: (1) motor running overcurrent protection; (2) unit controller and disconnect; (3) feeder and branch circuit conductors; and (4) feeder and branch circuit protection.

This discussion will attempt to define (1) the nature and function of circuit components involved in air-conditioning wiring; (2) the questions and differences of opinion which may arise in prescribing wiring and related equipment; and (3) a practical resolution of such differences. National Electrical Code provisions which are immediately concerned with air-conditioning wiring are presented for reference.

Motor Overcurrent Protection

Motor overcurrent protective devices are necessary to protect the motor, its associated controls, and the branch-circuit conductors against heat damage due to excessive motor currents. High currents may be caused by the motor being overloaded for a considerable period of time, by consistently low or unbalanced line voltage, by single-phasing of a polyphase motor, or by the motor stalling or failing to start.

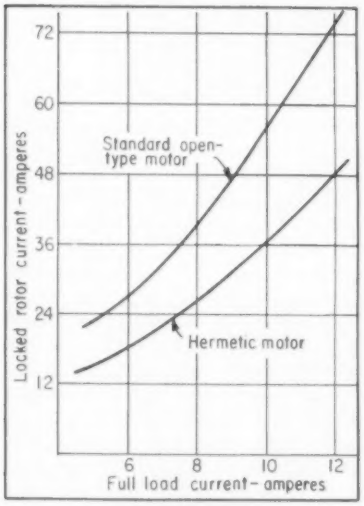


FIG. 1. Current comparison at locked-rotor conditions, typical small hermetic and open-type motors. Stalled rotor (or starting currents of hermetic motors are in the vicinity of 3 to 4 times the full-load currents while the open-type motor ratio is closer to 6 to 1.

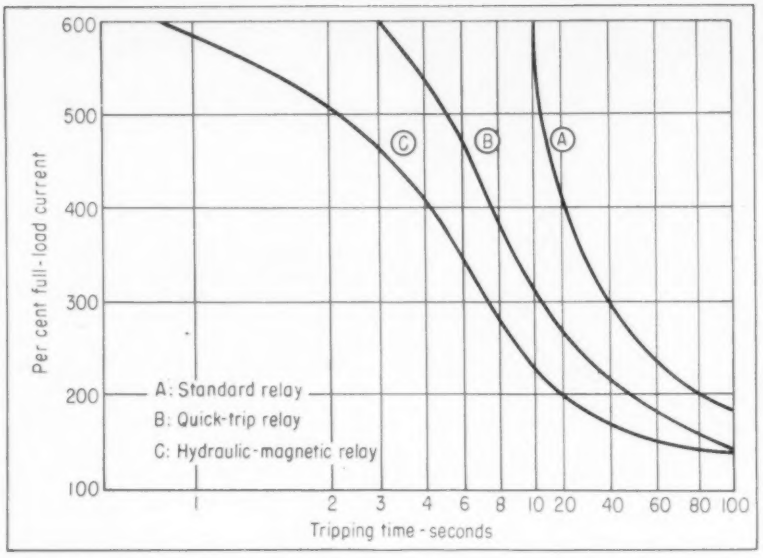


FIG. 2. Overload relay response to excess currents. Quick-acting relays represented by average curves B and C reduce tripping time considerably at high overloads, providing extra protection required by hermetic motors under locked-rotor conditions.

Damage may occur more quickly to a hermetic motor which stalls or fails to start than to a conventional open-type motor for two principal reasons: (1) Due to the presence of the cool refrigerant atmosphere under normal conditions, a hermetic motor is permitted to operate at a higher rated current which is closer to the locked-rotor current than is the rated current of an open-type motor of the same approximate size. (2) With the rotor at a standstill, there is no circulation of the refrigerant to carry away the heat; and the heat builds up in the windings. The curves of Fig. 1 typify the relation between locked-rotor and full-load currents of small open-type and hermetic motors.

Special quick-acting thermal and hydraulic-magnetic devices have been developed to reduce the time required to disconnect the hermetic motor from the line before damage occurs when an overload condition develops.

Tripping times vary with manufacturer and design; however, the curves of Fig. 2 give a typical comparison of quick-acting devices and standard overload relays. The appropriate current rating of these overload protectors is critical; many are rated within 0.1 amp. Therefore, the running overload protection for hermetic unit or packaged conditioner is either built in or supplied with the unit by the manufacturer.

All room air conditioners and packaged unit compressors rated up to 30 hp which are listed by Underwriters' Laboratories are required by UL to incorporate running overload protection which will restrict the heat rise to definite maximum safe temperatures in case of locked-rotor conditions. Room conditioners normally use inherent protectors built into the compressor housing which respond to the temperature of the housing. Two applications of inherent protection for single-phase hermetic motors are included in the diagrams of Fig. 3. Larger units also often use this type of protection in addition to the quick-acting overload heaters installed in the motor starter, which respond only to current.

A contractor or electrician will normally be concerned with the running overcurrent protection of a hermetic motor only when it becomes necessary to replace the existing devices supplied with the equipment. For this purpose, compressor manufacturers' warranties explicitly specify catalog numbers of replacements which are to be used to insure proper operation of the equipment.

To determine whether proper overcurrent protection has been

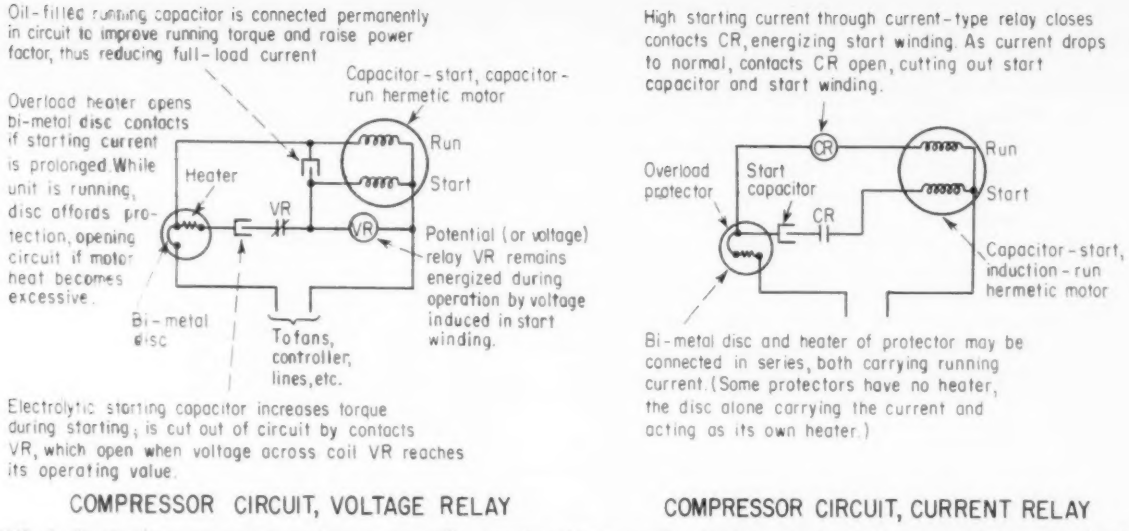

Oil-filled running capacitor is connected permanently in circuit to improve running torque and raise power factor, thus reducing full-load current
Capacitor-start, capacitor-run hermetic motor
Overload heater opens bi-metal disc contacts if starting current is prolonged. While unit is running, disc affords protection, opening circuit if motor heat becomes excessive.
Heater
VR
Run
Start
Potential (or voltage) relay VR remains energized during operation by voltage induced in start winding.
Bi-metal disc
To fans, controller, lines, etc.
Electrolytic starting capacitor increases torque during starting; is cut out of circuit by contacts VR, which open when voltage across coil VR reaches its operating value.
COMPRESSOR CIRCUIT, VOLTAGE RELAY
High starting current through current-type relay closes contacts CR, energizing start winding. As current drops to normal, contacts CR open, cutting out start capacitor and start winding.
Overload protector
Start capacitor
CR
Run
Start
Capacitor-start, induction-run hermetic motor
Bi-metal disc and heater of protector may be connected in series, both carrying running current. (Some protectors have no heater, the disc alone carrying the current and acting as its own heater.)
COMPRESSOR CIRCUIT, CURRENT RELAY

FIG. 3. Single-phase compressor motors are normally capacitor-start type, the starting capacitor being removed from the circuit by relay arrangements such as those shown here. Illustrated also are two common hookups of the inherent overload protector.

provided, the electrician or inspector is guided by the provisions of NEC Sections 4322-a-1, 4322-c-1 and 4324, as amended by Interim Amendment No. 104 dated August 12, 1957. The heater chosen for the hermetic motor starter must be rated or set at not more than 125% of the motor full-load current for hermetic motors having a locked-rotor value not exceeding 160 amps. For larger ratings, the overcurrent size must not exceed 115%. If the computed value does not correspond to a standard size protective device, the next higher available rating may be used, with an absolute maximum of 140% for hermetics up to 160 amps locked rotor, and 130% for larger ratings.

Equipment in excess of 30 tons requires custom engineering and installation accomplished through close cooperation with the manufacturer.

Controller and Disconnect

The NEC in Sections 4403b and 4383e outlines the method to be used for determining the minimum safe ratings of controllers and disconnects for hermetic motors. Controllers encountered in packaged air conditioning equipment are for the most part across-the-line magnetic starters operated by some type of selector switch, pushbutton station, time clock or thermostat. Smaller window units use only a selector switch with necessary

Running Overcurrent Protection

(NEC Excerpts)

Interim Amendment No. 104:

Sec. 4322-a-1 and Sec. 4322-c-1: A separate overcurrent device . . . shall be rated or set at not more than 125% of the motor full-load current rating for sealed (hermetic-type) refrigeration compressor motors having a locked-rotor value not exceeding 160 amp and motors marked to have a temperature rise not over 40C, and at not more than 115% for all other types of motors.

Sec. 4324. Where the values specified for motor-running overcurrent protection do not correspond to the standard sizes . . . the next higher size . . . may be used, but not higher than 140% of the full-load current rating of sealed (hermetic-type) refrigeration compressor motors having a locked-rotor value not exceeding 160 amp and motors marked to have a temperature rise not over 40C, and not higher than 130% of the full-load current rating for all other motors. If not shunted during the starting period of the motor . . . , the protective device shall have sufficient time delay to permit the motor to start and accelerate its load.

Controllers

(NEC Excerpts)

Sec. 4382. Each controller shall be capable of starting and stopping the motor which it controls, and for an alternating current motor shall be capable of interrupting the stalled-rotor current of the motor.

Sec. 4383-e. Motor controllers rated in terms of full-load current and current-interrupting capacity shall be selected on the basis of both the nameplate full-load current and locked-rotor current, respectively, of the compressor motor.

Motor controllers rated in horsepower or in horsepower and full-load current shall be selected on the basis of the nameplate full-load current and locked-rotor current, respectively, of the compressor motor.

For full-load current, the horsepower rating shall be selected from Tables 22 to 24, and for locked-rotor current, from Table 25.

Disconnects

(NEC Excerpts)

Sec. 4403-a. The disconnecting means shall have a carrying capacity of at least 115% of the nameplate current rating of the motor.

Sec. 4403-b. The disconnecting means shall be selected on the basis of the nameplate full-load current and locked-rotor current, respectively, of the compressor motor.

For full-load current, the horsepower rating shall be selected from Tables 22 to 24, and locked-rotor current, from Table 25.

Sec. 4406. The disconnecting means shall disconnect both the motor and the controller from all ungrounded supply conductors.

Sec. 4409. The disconnecting means shall be located in sight from the controller location or be arranged to be locked in the open position. (A distance of more than 50 ft is considered equivalent to being out of sight.)

Motor Circuits

(NEC Excerpts)

Sec. 4309-b. The current-carrying capacity of the branch-circuit conductors, branch-circuit overcurrent protection and motor running overcurrent protection shall be selected on the basis of the full-load current marked on the compressor nameplate.

Sec. 4312. Branch-circuit conductors supplying an individual motor shall have a carrying capacity not less than 125% of the motor full-load current rating.

Sec. 4314. Conductors supplying two or more motors shall have a current-carrying capacity of not less than 125% of the full-load current rating of the highest rated motor in the group plus the sum of the full-load current ratings of the remainder of the motors in the group.

Sec. 2203-e. Where four or more fixed appliances in addition to electric ranges, air conditioning equipment or space heating equipment are connected to the same feeder in a single or multi-family dwelling, a demand factor of 75% may be applied to the fixed appliance load, but not including electric ranges, air conditioning equipment or space heating equipment.

In adding the branch circuit loads to determine the feeder load, the smaller of two dissimilar loads may be omitted from the total where it is unlikely that both of the loads, such as an electric heating load and an air cooling load, will be served at any time during any 24-hour period.

Lighting and Appliance Circuits

(NEC Excerpts)

Sec. 2103. Branch circuits recognized by Art. 210 shall be classified in accordance with the maximum permitted rating or setting of the overcurrent device.

Sec. 2122-a. The rating or setting of overcurrent devices shall not be in excess of the carrying capacity of the circuit conductor.

Sec. 2125-a. The total load shall not exceed 80% of the branch circuit rating if motor-operated appliances are supplied.

The total load of motor-operated air-conditioning equipment shall not exceed 80% of the rating of a branch circuit which does not supply lighting units or other appliances.

Sec. 4293-2. The total load of air-conditioning equipment shall not exceed 50% of the rating of a branch circuit if lighting units or other appliances are also supplied.

Sec. 4343-a. Two or more motors, each having a full-load rated current not exceeding 6 amps, may be used on a branch circuit protected at not more than 20 amps at 125 volts or less, or 15 amps at 600 volts or less.

starting relays. This control equipment is normally furnished by the manufacturer and often is supplied completely wired and built into a control panel in the conditioner.

Starters used for ac motor loads must be able to carry continuously the full-load current of the motor and must be able to interrupt the stalled-rotor current if necessary (NEC Section 4382). Standard motor starters are normally rated in horsepower and are designed to handle the usual current-carrying and current-interrupting capacities associated with the horsepower rating.

For example, a 3-phase controller rated at 5 hp is capable of starting and stopping a standard 3-phase, 5-hp motor (7.5 amps running current) and of interrupting the locked-rotor current (approximately 45 amps) if required to do so. Selection of a controller for a standard motor, then, is strictly on the basis of the horsepower of the motor to be controlled (plus the particular operations that the controller must perform—stopping, starting, reversing, etc.).

However, hermetic motors are not rated in horsepower, but in terms of running current and locked-rotor current. Thus, the required horsepower rating of the starter is not immediately apparent. The NEC stipulates (Sec. 4383e) that when a controller is to be procured for a hermetic motor and the controller is rated in horsepower, Tables 22, 23, 24 and 25 of the code are to be used to establish the proper minimum horsepower rating.

For example, a 3-phase, 440-volt hermetic motor rated at 11 amps full load and 60 amps locked rotor is to be supplied with a controller. Assume that the controllers to be used are rated only in horsepower. To make sure the controller selected will handle the running current, Table 24 is used. This table lists 7½ hp as the required size for a 440-volt, 11-amp motor. To insure adequate interrupting capacity, Table 25 is used. For a 60-amp locked-rotor current, this table also shows 7½ hp as the required size. Use of both tables in this manner thus establishes the 7½-hp controller as adequate for the given motor in both respects. Had the two ratings as obtained from the two tables been different, the higher rating would have been chosen.

Many starters intended specifically for air-conditioning use are

now being rated directly in terms of full-load current and may be selected for particular hermetic motors without reference to horsepower ratings or Tables 22 through 25. Such starters are designed to handle the locked-rotor current normally associated with each full-load current rating.

Disconnects are required by the code for the purpose of isolating motors and their controllers from the circuit (Sec. 4401 and 4402). They are required to be in sight from the motor and within 50 ft. They are not normally supplied by the manufacturer of the air conditioning equipment, since the specific type of disconnect to be used depends upon the distribution system to which the conditioner is to be connected and the wishes of the planning personnel.

Motor disconnects are rated in horsepower and are designed to carry the 115% nameplate current as required by NEC Section 4403a. To relate their horsepower ratings to the current ratings of hermetic motors, Tables 22 through 25 are used in the same manner as for selecting the controller rating (Sec. 4403b).

Where general-use switches or other means of disconnect are used as permitted by the code, they must have a carrying capacity of not less than 115% of the motor full-load current (Sec. 4403a).

Conductors

Branch circuit conductors feeding a hermetic motor load are sized in the same manner as other motor loads (NEC Sec. 4309b; 4312) except that nameplate full-load current values must be used. In addition, Sec. 4293 restricts the loading on a branch circuit supplying air conditioning equipment to 80% of the circuit rating (see Fig. 11).

Some confusion exists over the application of this provision, since a branch circuit is normally classified by the capacity of its short-circuit protection (Sec. 2103). Where motor circuits are involved, circuit protection may be several times the safe carrying capacity of the conductors; hence the rating of the protective device can hardly be used to classify the conductors. In the absence of any note in Sec. 4293 clarifying its relation to the provisions of Article 430, it must be assumed that the intent of Sec. 4293 is to regulate the loading of the type of lighting and appliance circuits to which small window- and through-the-wall units are connected whose conductors are classified in accordance with their carrying capacity, as provided in Sec. 2122a.

In other words, a No. 14 branch circuit may not be loaded beyond 80% x 15 or 12 amps; a No. 12 circuit may not be loaded beyond 80% x 20 or 16 amps. Sec. 4293 obviously establishes the 80% figure in recognition of the continuous loading conditions imposed upon the circuit by the air conditioners and to insure the extra conductor capacity normally required for motor loads by Article 430.

As far as Article 430 is concerned, this 80% loading is accomplished in effect by the provisions of Sec. 4312 requiring branch circuit conductors to have a carrying capacity not less than 125% of the motor full-load current rating—although the 125% factor is established not for reasons of continuous loading but because of the special characteristics of motor loads. Where more than one conditioning motor is connected to the same circuit, however, calculation of conductor sizes using the provisions of Sec. 4314 (125% full-load current of highest rated motor plus sum of full-load currents of other motors) will in many cases result in circuit loading exceeding 80%. In such cases the problem of continuous loading should be kept in mind and sufficient capacity provided.

This is particularly important since the nameplate full-load current rating of the conditioning motors is not a constant maximum value during operation. This rating is established and tested under standard conditions of temperature and humidity. Operation under weather conditions more severe than those at which the ratings are established will result in a greater running current, which can approach the maximum value permitted by the overcurrent device. Operating voltage less than the limits specified on the motor nameplate also contributes to higher full-load current values, even under standard conditions.

Sec. 2203f directs that motor feeders are to be sized according to Sec. 4314. Since overcurrent pro-

NEC Table 24. Full-Load Current Three-Phase AC Motors

Horsepower	Induction Type Squirrel-Cage and Wound Rotor Amperes			
	110-volt	220-volt	440-volt	550-volt
1½	10	5	2.5	2.0
2	13	6.5	3.3	2.6
3		9	4.5	4
5		15	7.5	6
7½		22	11	9
10		27	14	11

Note: Only that portion of Table 24 is extracted here which is concerned with the present discussion.

NEC Table 25 Interrupting Capacity of Motor Controller and Disconnecting Means

Maximum Horsepower Rating	Maximum Interrupting Capacity—Amperes Two or Three Phase			
	110-volt	220-volt	440-volt	550-volt
1½	60	30	15	12
2	78	39	19.8	15.6
3	....	54	27	24
5	....	90	45	36
7½	....	132	66	54
10	....	162	84	66
15	....	240	120	96

Note: Only that portion of Table 25 is extracted here which is concerned with the present discussion.

Short-Circuit Protection

(NEC Excerpts)

Sec. 4343-b. See Fig. 4.

Sec. 4342. The motor-branch-circuit overcurrent device shall be capable of carrying the starting current of the motor. Overcurrent protection shall be considered as being obtained when this overcurrent device has a rating or setting not exceeding the values given in Tables 26 or 27; provided that where the overcurrent protection specified in the table is not sufficient for the starting current of the motor, it may be increased, but shall in no case exceed 400% of the motor full-load current.

Sec. 4362. A feeder which supplies a specific fixed motor load and consists of conductor sizes based on Sec. 4314 shall be provided with overcurrent protection which shall not be greater than the largest rating or setting of the branch-circuit protective device for any motor of the group (based on Tables 26 and 27) plus the sum of the full-load currents of the other motors of the group.

Sec. 2434-c. Overcurrent devices shall be located at the point where the conductor to be protected receives its supply, except if (1) the smaller conductors have a current-carrying capacity of not less than the sum of the allowable current-carrying capacities for the conductors of the one or more circuits or loads supplied, (2) the tap is not over 10 ft long and does not extend beyond the switchboard, panelboard or control devices which it supplies.

tection may permit motors to run continuously (up to 140% full load) overloaded, the feeder must be sized to handle such an overload. By basing the calculations on the largest motor of the group, the extra capacity thus provided will normally be more than enough to handle any unforeseen overload on the smaller motors involved, enough diversity existing in any normal group of motors to make consistent overloads on all motors at one time unlikely.

However, a group of air-conditioning compressor motors all of the same size on a single feeder have a common function: reducing the ambient temperature. Except for slight possible variations, weather conditions affect each conditioner to the same degree and at the same time. Therefore if one unit is operating at an overload, it is likely that the rest are also.

This factor should be taken into consideration when sizing air conditioning feeders. Recognition for feeders of the 80% loading imposed by Sec. 4293 on branch circuits, even though variations of demand may be expected due to on-and-off compressor operation, will result in improved operation under extended periods of overload or unexpected undervoltage.

In connection with feeder loading, the air conditioner has been added by the code to the group of fixed appliances which may not be considered in applying the 75% demand factor accorded four or more fixed appliances in computing feeder sizes for single or multi-family dwelling (Sec. 2203e). This section goes on to say that, in adding branch circuit loads to determine the feeder load, the smaller of two dissimilar loads may be omitted from the total where it is unlikely that both of the loads, such as an electric heating load and an air cooling load, will be served at any time *during any* 24-*hour period*.

Why the 24-hour period stipulation? Normally, of course, heating and air conditioning are not needed at the same time. However, there are sections of the country that

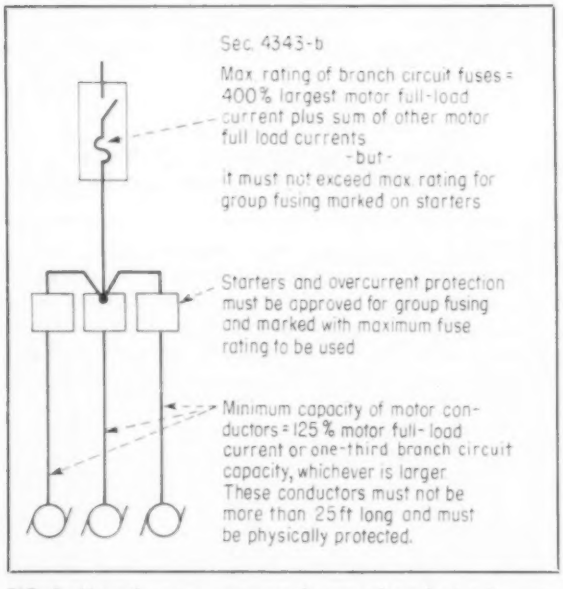

Sec. 4343-b
Max. rating of branch circuit fuses = 400% largest motor full-load current plus sum of other motor full load currents
-but-
it must not exceed max. rating for group fusing marked on starters
Starters and overcurrent protection must be approved for group fusing and marked with maximum fuse rating to be used
Minimum capacity of motor conductors = 125% motor full-load current or one-third branch circuit capacity, whichever is larger. These conductors must not be more than 25 ft long and must be physically protected.

FIG. 4. More than one motor on the same branch circuit must meet the requirements of Section 4343b. Pertinent provisions are summarized above.

FIG. 5. Several Motors on Same Circuit

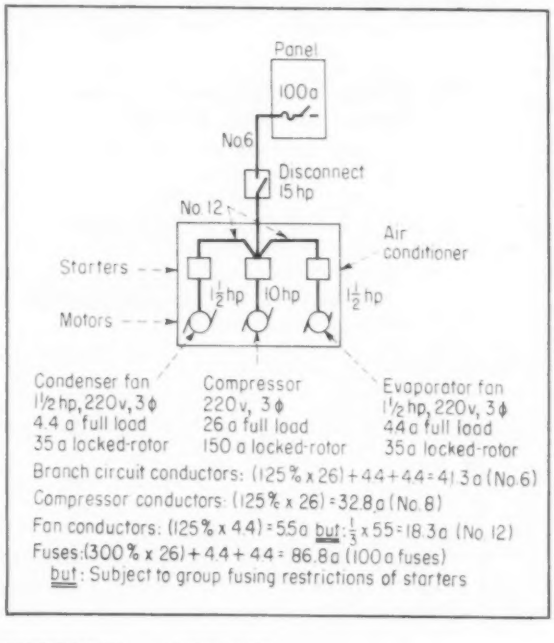

Panel
100a
No.6
Disconnect
15 hp
No.12
Air conditioner
Starters
Motors
1½ hp
10 hp
1½ hp
Condenser fan
1½ hp, 220v, 3φ
4.4 a full load
35 a locked-rotor
Compressor
220 v, 3φ
26 a full load
150 a locked-rotor
Evaporator fan
1½ hp, 220v, 3φ
4.4 a full load
35 a locked-rotor
Branch circuit conductors: (125% x 26) + 4.4 + 4.4 = 41.3 a (No.6)
Compressor conductors: (125% x 26) = 32.8 a (No.8)
Fan conductors: (125% x 4.4) = 5.5 a but: ⅓ x 55 = 18.3 a (No.12)
Fuses: (300% x 26) + 4.4 + 4.4 = 86.8 a (100 a fuses)
but: Subject to group fusing restrictions of starters

FIG. 6. Separate Fuses for Fan Motors

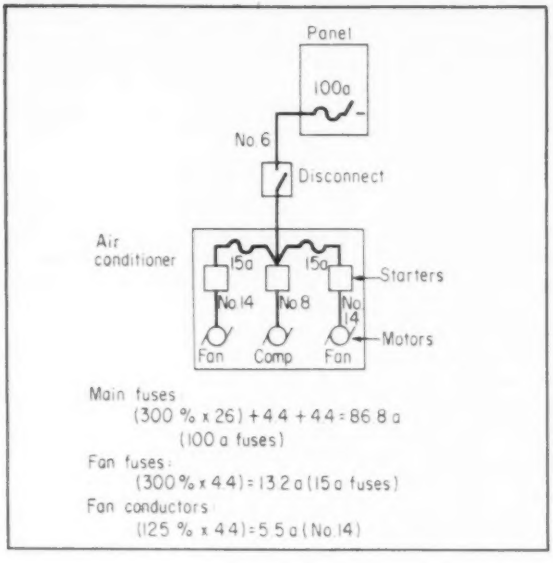
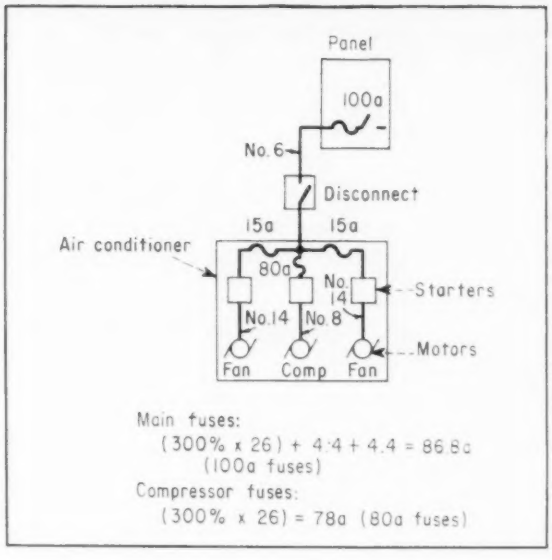


FIG. 7. All Motors Fused Within Unit



have rather extreme fluctuations of temperature in a 24-hour period, so that the sunny side of a building may warm up quickly in the morning and require air conditioning while the other side, without sun, may still be chilly enough to require heating. If the same feeder serves both sides of such a building, it will carry heating and cooling loads simultaneously and must be sized accordingly.

Another exception would occur when electric heating is used to reduce the effects of air conditioning. There are installations where (due to existing capacities of conditioning equipment, economical limitations of control facilities, or configuration of the building involved) some rooms or areas in the building prove to be too cool when the major portion of the building is at a comfortable temperature. It is sometimes simpler to provide local heat with electric heating units rather then to attempt major modification of the air conditioning system to correct these inconsistencies. A common feeder to both loads would of course be required to have capacity sufficient for the total of the two loads.

Examples of branch circuit and feeder size calculations for common wiring methods are included in the diagrams of Fig. 5 through 9. The calculations are explained and pertinent code rules indicated in the following discussion of circuit protection.

Short-Circuit Protection

PACKAGED UNITS: Air conditioning equipment (other than small room units and large custom installations) is manufactured in the form of packaged units having all necessary components mounted in one or more enclosures designed for floor mounting, for recessing into walls, for mounting in attics or ceiling plenums, for locating outdoors, etc.

Electrical wiring in and to these units varies with the manufacturer, and the extent to which the electrical contractor need be concerned with fuse and circuit breaker calculations depends upon the manner in which the units' motors are fed, the type of distribution system to which they are to be connected, etc.

The following discussion and the diagrams of Fig. 5 through 9 illustrate the most common arrangements of electrical circuits and the considerations determining choice of short-circuit protection rating and size of circuit conductors. Wire sizes indicated are Type R or equivalent rating. Fuse values shown refer to standard type fuses, although substitution of time-delay fuses of the same or smaller capacity is common practice to reduce nuisance interruptions during starting and, in many cases, to permit use of smaller fuseholders and switches. Conductor sizes given do not provide for voltage drop.

(A) All motors on one branch circuit. Equipment of this type is tested by Underwriters' Laboratories for conformance with the group fusing requirements of NEC Sec. 4343b. UL Standard 465 on Central Cooling Air Conditioners requires that, where a single branch circuit feeds more than one motor, the maximum permissible fuse size must be indicated on the conditioner or on an attached wiring diagram.

The UL *Electrical Appliance and Utilization Equipment List* in its General Information section under "Air Conditioners, Central Cooling" states: "The suitability of motor and branch circuit protection afforded two or more motors operating from a single branch circuit has been covered in these listings and the maximum rating of the branch circuit overcurrent protective device marked on the air conditioner. The proper method of installation (number of branch circuits, etc.,) is shown on the wiring diagram or marking required to be attached to the air conditioner."

Therefore, the electrical contractor and inspector charged with wiring and approving such an installation can be sure that code requirements have been met—provided that the branch circuit protection as specified on the unit is not exceeded and the wiring and equipment is as indicated on the wiring diagram. Provision is made in such a unit for direct connection to the branch circuit conductors; motors

are wired internally by the manufacturer.

Units such as this with all motors wired to the same branch circuit must meet the requirements of Sec. 4343b (see Fig. 4). Motor starters and their associated running overload heaters must be chosen from those approved for group fusing. Such approval is indicated in the UL *Electrical Construction Materials List* under Motor Controllers by a statement such as the following: "Suitable for use when protected by fuses of ratings greater than four times the full-load current of the motor which it is designed to control. Each device marked with the rating of the maximum fuse with which they may be used. (Group Fusing)".

For the unit shown in Fig. 5, the compressor starter size chosen on the basis of Tables 24 and 25 would be 10 hp with overload heaters rated at 1.25 x 26 or 32.8 amps (or closest available rating to this value)—and the starter would have to be listed as suitable for group fusing. Fan motors are 1½ hp, hence 1½-hp starters with heaters rated as closely as possible to 1.25 x 4.4 or 5.5 amps would be used—also approved for group fusing.

If a fuse panel is to be used, is in sight from the unit and is within 50 ft of the unit, fused switches in the panel may serve as the disconnecting means (Sec. 4409). Otherwise, an additional disconnect is required in sight of the unit and within 50 ft, as shown in the diagram.

Fan motors are usually wired to start slightly ahead of the compressor motor through use of interlock contacts or a time-delay relay. In some units, however, all motors start simultaneously. Where this is the case, the starting load will look like a single motor to the disconnect switch, and the sum of the locked-rotor currents of all motors should be used with Table 25 to determine the rating of the disconnect. It normally must handle the sum of the full-load currents, hence the rating as checked against Table 24 will be on the basis of the sum of the full-load currents. Table 24, using the full-load total of 34.8 amps in this example, indicates a 15-hp disconnect. Table 25, assuming simultaneous starting of all three motors and using the total locked-rotor current of 220 amps, also shows 15 hp as the required size.

If motors do not start simultaneously, the compressor locked-rotor current (150 amps) used with Table 25 gives a 10-hp rating. However, the higher of the two must be used; hence the running currents impose the more severe requirements and dictate the switch size.

Circuit conductors required to feed the unit would be No. 6 (Sec. 4314). Current-carrying capacity of No. 6 wire is 55 amps; total connected load is 34.8 amps. Capacity is sufficient even with all motors running at 140% of rated current.

Where more than one motor is connected to the same branch circuit, Sec. 4343-b-3 specifies that fuse protection be computed as in Sec. 4342 for the largest motor plus the sum of the full-load currents of the other motors. Since Sec. 4342 permits fuses rated at a maximum of 400% full-load current, it is generally interpreted that Sec. 4343-b-3 also permits the 400% figure to be used.

However, in the case of a single motor the 400% is a maximum to be used only when 300% is insufficient for starting. It follows that use of the 400% for fuses protecting more than one motor should likewise be a maximum value, and that 300% (for squirrel-cage motors) should be used for all general calculations.

For the example in Fig. 5, this would result in 100-amp fuses. However, the fan controller marking may restrict the fuses to a lower value. The problem of choosing fuses which will satisfy the group fusing requirements and yet have sufficient capacity to permit normal operation of the unit without nuisance tripping obviously is one which the manufacturer is better equipped to handle than the man in the field, hence his recommendations should be followed.

B. Separate fuses for fan motors: Units are sometimes encountered in which the manufacturer has wired separate fuse cutouts for the fan motors inside the enclosure to avoid meeting the requirements of Sec. 4343 for group fusing (see Fig. 6). The cutouts are normally fed from the line terminals of the compressor starter.

Starter and disconnect sizes are the same as in (A) above, but starters and their overcurrent protection no longer need be approved for group fusing, and wiring inside the unit need not conform to Sec. 4343b. Fan motors may now be wired with No. 14 wire and protected with 15-amp fuses. The supply circuit, feeding the same motors, will again be No. 6.

Since the fan motors are not subject to group fusing requirements, they will not restrict the maximum value of the main fuses. However, these fuses provide the only short-circuit protection for the compressor starter and conductors. Unless the compressor starter is approved for group fusing at a higher fuse rating, the fuses must not exceed 400% of the compressor full-load rating, or 104 amps, calling for 100-amp fuses.

The question arises as to whether the No. 6 conductors feeding the unit may be decreased to No. 8 inside the unit to feed the compressor motor in the absence of fuses for this motor at the point of reduction. The status of the main feed to the unit—whether it should be considered a feeder or a branch circuit—is in doubt, since it is a branch circuit as far as the compressor motor is concerned and a feeder in that it supplies the two fused fan circuits.

Considered solely as a branch circuit to the compressor, these conductors normally would be No. 8 to handle the 26-amp compressor motor full-load current, protected at not more than 400% or 100-amp fuses. Therefore, since 100-amp fuses (or less) will actually be used for the main feed, they constitute proper protection for No. 8 conductors and their use should be permitted. The existence of No. 6 conductors over part of the circuit adds to its capacity and safety rather than detracting from it.

C. All motors fused: Units are also wired with fuse blocks for all motors, as shown in Fig. 7. The compressor motor would be fused at 80 amps, with remaining fuses and conductors as above.

Main fuses no longer are subject to restrictions by motor starters and are sized as feeder protection per Sec. 4362 as shown by the diagram. This again results in 100-amp fuses.

However, it is very likely that an arrangement such as this would result in double blowing of the 80- and 100-amp fuses, the differential between the two being too small. The need for time-delay fuses is indicated, using perhaps a 30-amp fuse for the compressor and a 50-amp fuse for the main.

In A, B and C above it has been assumed that units were to be sup-

plied from a main panelboard through a disconnect switch at the unit. In many cases, units are located close to main risers or busway feeders, so that fused disconnects may be used to serve as both the disconnecting means and main short-circuit protection.

(D) Three branch circuits: This method is highly desirable (see Fig. 8), since branch circuit protective devices are external to the unit and each motor is independent of the others. This simplifies servicing and reduces the inconvenience in many cases of having an entire unit disabled in the event of trouble on a single motor. The panel is normally located adjacent to the conditioner and may contain circuits other than those shown, such as external protection for the control circuit if required. Calculations and ratings are the same as in (C) above. (See photos on first page.)

(E) Circuit breakers as disconnects: The above examples refer exclusively to fused disconnects and fused switches to maintain the continuity of calculations. However, Sec. 4402 recognizes the circuit breaker also as a disconnecting means; hence fused disconnects and fuse panels referred to in the above examples could also have been circuit breakers or circuit-breaker panels (except in Fig. 5; literal interpretation of Sec. 4343-b-3 permits only fuses as protection for more than one motor on the same branch circuit).

Fig. 9 shows an arrangement which includes, in addition to the branch-circuit panel, a feeder panel for distribution to other units. The breakers in the branch-circuit panel serve as branch circuit protection as well as the disconnecting means, and their rating is computed per Sec. 4342 and Tables 26 or 27, Chapter 10, using motor nameplate currents (Sec. 4403-b). Tables 20 to 25 would not be involved, since breakers are not rated in horsepower. To satisfy Sec. 4406, the breakers would have to disconnect the unit from all ungrounded conductors.

Branch circuit conductors are calculated as in the preceding examples. Ratings of circuit breakers in the branch-circuit panel, however, are computed as 250% of motor full-load current, not 300%, in accordance with Table 27.

The sub-feeder between panelboards is sized per Sec. 4314; breakers in this panel are rated using

FIG. 8. Three Branch Circuits to External Panelboard

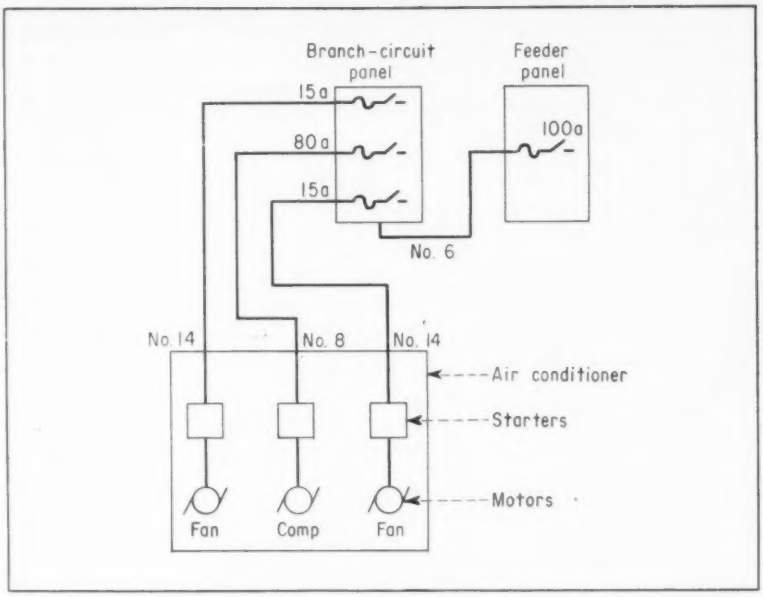
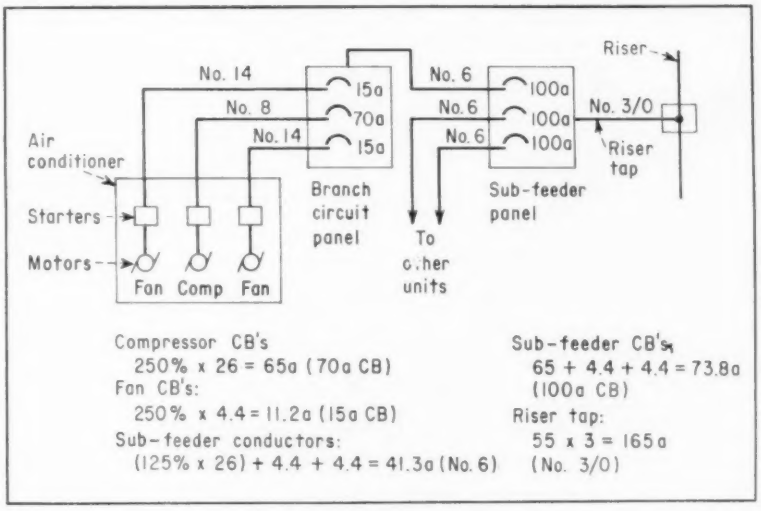


FIG. 9. Circuit Breakers for Protection and Disconnect



Compressor CB's
250% x 26 = 65a (70a CB)
Fan CB's:
250% x 4.4 = 11.2a (15a CB)
Sub-feeder conductors:
(125% x 26) + 4.4 + 4.4 = 41.3a (No. 6)

Sub-feeder CB's
65 + 4.4 + 4.4 = 73.8a
(100a CB)
Riser tap:
55 x 3 = 165a
(No. 3/0)

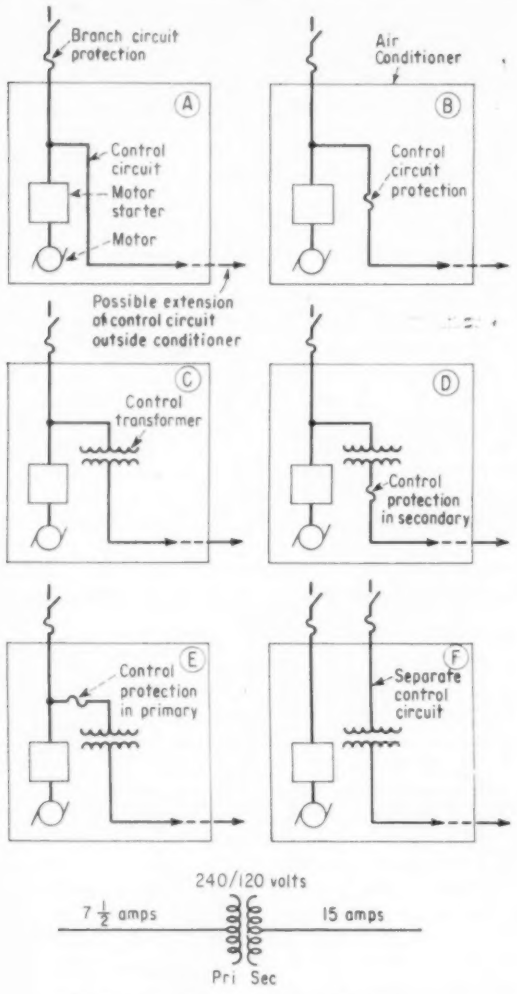
Control Circuit Protection

(NEC Excerpts)

Sec. 2403-g. The conductors of the control circuits of remote-control switches shall be considered as protected from overcurrent by overcurrent devices that are not of the so-called time-lag type and are rated or set at not more than 500% of the carrying capacity of the remote-control conductors.

Sec. 4372-a and 4372-b. Conductors of control circuits shall be protected against overcurrent in accordance with Sec. 2403-g, except that such conductors shall be considered as being properly protected by the branch circuit overcurrent devices if the rating or setting of the branch-circuit overcurrent device is not more than 500% of the carrying capacity of the control-circuit conductors; or if the controlled device and the point of control . . . are both located on the same machine and the control circuit does not extend beyond the machine.

FIG. 10. Protection of Control Circuits



With 2:1 transformer voltage ratio, 15-amp conductor-carrying capacity in secondary would be reflected in primary as 7½ amps.

A. Branch circuit protection is not greater than 500% control conductor carrying capacity.

No control circuit protective devices are required, regardless of whether control conductors leave conditioner or not.

B. Branch circuit protection greater than 500% control conductor carrying capacity.

If control conductors do not leave conditioner, no control circuit protection is required. If control conductors leave conditioner, control circuit protection is required with max. rating of 500% control conductor capacity and must not be of time-lag type.

C. Control transformer is furnished with unit; branch circuit protection is not greater than 500% control conductor capacity **as reflected in primary.**

No control circuit protective devices are required, regardless of whether control conductors leave conditioner or not.

D. Control transformer is furnished with unit; branch circuit protection is greater than 500% control conductor capacity **as reflected in primary.**

If control conductors do not leave conditioner, no control circuit protection is required. If control conductors leave conditioner, control circuit protection is required with max. rating of 500% control conductor capacity and must not be of time-lag type. Protection may be provided in secondary as shown or in primary as in (E)

E. Where control circuit protection is required as specified in (D), protective device may be placed in primary.

Max. rating is 500% control conductor capacity **as reflected in primary,** not of the time-lag type

F. Separate control circuit must be protected with max. rating of 500% control conductor capacity **as reflected in primary** and not of the time-lag type, with disconnecting means.

Sec. 4362. The tap from the main riser to the sub-feeder panel need not be protected at the riser provided that the provisions of Sec. 2434-c are fulfilled. That is, the tap must not be over 10 ft long, it must be enclosed in raceway, and its carrying capacity must be not less than the sum of the sub-feeder capacities. Assuming that all three of the conditioners indicated are identical, three No. 6 feeders would have a total carrying capacity of 165 amps, requiring a 3/0 tap.

If an additional breaker were installed at the riser, it would be sized in accordance with Sec. 4362: (250% × 26) plus (2 × 26) plus (6 × 4.4) or 143.4 amps. Closest standard breaker size would be 150 amps. The conductors between this breaker and the sub-feeder panel would no longer have to meet the requirements of the 10-ft tap rule (Sec. 2434c), hence their size would be computed per Sec. 4314: (125% × 26) plus (2 × 26) plus (6 × 4.4) or 110.9 amps, permitting No. 1/0 instead of the No. 3/0 computed without the breaker.

Protection of control circuits: Control circuits in packaged units may operate at the same voltage as the unit's motors or at a lower voltage, obtained through the use of a control transformer. It is normal to find units with 220-volt motors using a 220-volt control circuit, the control circuit receiving its supply from the line terminals of the motor starter. However, 440-volt units usually incorporate a 440/220-volt or 440/115-volt transformer to obtain the lower voltage control.

The usual control circuit consists of a series circuit connecting all devices which function to start or stop the unit, such as contactor coils, overload heaters, thermostats and pressure cutouts. Units employing more than one compressor motor may connect two such control circuits in parallel.

A transformer mounted within the air conditioner enclosure does not require overcurrent protection as specified in Art. 450, since "dry-

type transformers which constitute a component part of other apparatus and which conform to the requirements for such apparatus" are excepted from the provisions of Art. 450 (Sec. 4501).

Sec. 2403g specifies that remote-control conductors must be protected at not more than 500% of the carrying capacity of the conductors. However, this requirement is superseded by Sec. 4372 if the branch circuit overcurrent device is not more than 500% the carrying capacity of the control circuit conductors or the control circuit does not extend beyond the conditioning unit.

All ungrounded conductors of the control circuit must be disconnected from the source of supply either by the disconnecting means of the circuit by which it is fed or by a separate disconnecting means (Sec. 4374).

Thus, where branch circuit fuses are not in excess of 500% of the control circuit conductors' capacity, no separate fuses need be installed for the control circuit—whether or not the control conductors leave the unit. If they do leave the unit, however, and the branch circuit fuses are in excess of 500% of the control circuit conductors' capacity, separate fuses are required. Such fuses could be avoided by increasing the size of the control conductors.

Control circuits incorporating a transformer which require separate protection may be fused in the primary rather than in the secondary, thus protecting the transformer as well as the control conductors. Maximum rating of these fuses would be 500% of the control conductor carrying capacity, *as reflected in the primary*. Assuming a 2:1 ratio of primary to secondary voltage, a 15-amp capacity control conductor in the secondary would appear as 7½ amps in the primary, hence primary fuses would be limited to a maximum of 7½ × 5 or 37½ amps. Suitable transformer protection, however, will in most cases be a great deal less than 37½ amps.

The diagrams of Fig. 10 illustrate these provisions. The remote-control overcurrent provisions of Art. 725 do not apply to circuits which form an integral part of a device, such as an air conditioner.

ROOM AIR CONDITIONERS: The provisions of Sec. 4293 were intended to clarify the application of room air conditioners connected to lighting and appliance circuits. The provisions of Sec. 4293-1 restricting the loading of such circuits to 80% has been discussed above in connection with circuits which feed only air conditioning loads, illustrated in Fig. 11.

Sec. 4293-2, however, permits air conditioning units to be plugged into *existing* circuits which supply lighting loads or other appliances. By the provisions of this section, such a conditioner must not draw more than 7½ amps full load (nameplate rating) when connected to a 15-amp, No. 14 circuit; not more than 10 amps when connected to a 20-amp, No. 12 circuit. In addition, the *existing* load on the circuit (lights or other appliances) must be low enough so that the total load on the circuit after the addition of the air conditioner is not greater than 12 amps in the case of the 15-amp circuit, nor greater than 16 amps on a 20-amp circuit. This is in accordance with Sec. 2125a, which restricts the total loading on such a circuit to 80% of the circuit rating.

Assuming that a 7½-amp conditioner is connected to such a 15-amp existing circuit, it would mean that the circuit before the addition of the air conditioner could have been loaded to no more than 4½

FIG. 11. Individual Circuit to Room Conditioner

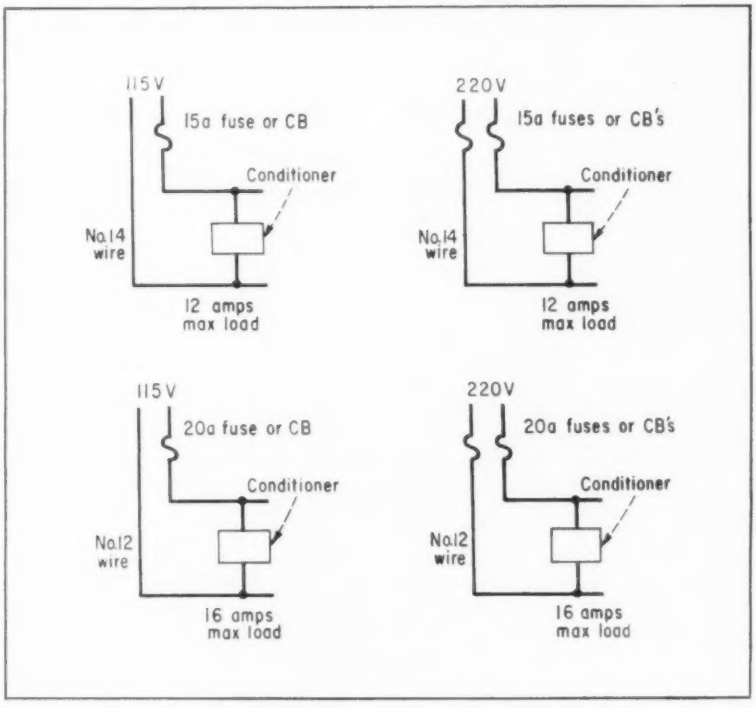


FIG. 12. Room Conditioner on Existing Circuit

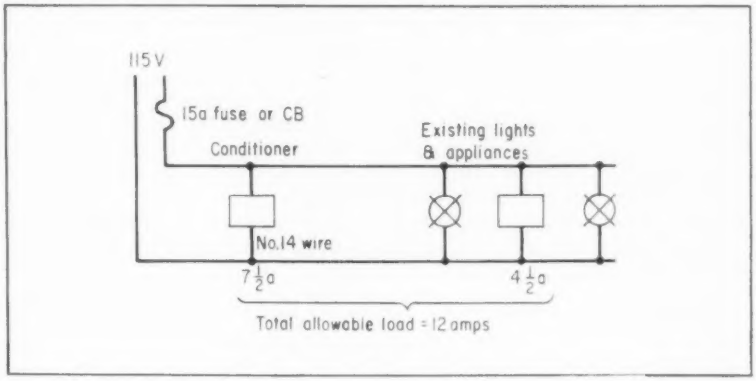
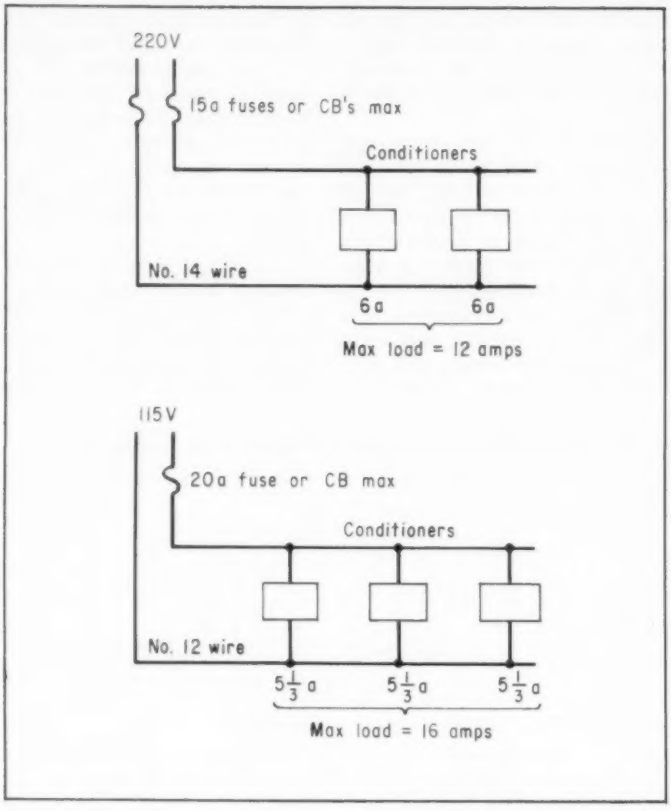


FIG. 13. Several Conditioners on One Circuit



amps. At 115 volts, this would mean 517.5 watts. It is unusual indeed to find existing circuits so lightly loaded; consequently the provisions of Sec. 4293 have been widely abused in this respect (see Fig. 12).

Relative to these provisions is the problem of connecting two or more conditioners to the same circuit. Compressor and fan motors and their controls in the same enclosure and fed by one circuit are approved by UL for group installation when the unit is tested. However, an air conditioner's component parts carry no general group-fusing approval which would permit several separate conditioners to operate on the same circuit. Therefore, the requirements of Sec. 4343b could not be satisfied. To connect more than one conditioner to the same branch circuit, the provisions of Sec. 4343a must be fulfilled. This section restricts the motors to a maximum of 6 amps at 125 volts or less, or 15 amps at 600 volts or less.

Technically, then, two 115-volt, 6-amp conditioners (or three 5-amp conditioners, etc.) could be used on the same 20-amp (No. 12 wire) circuit which supplies no other load; and two 220-volt, 6-amp units could be operated on the same 15-amp (No. 14 wire) circuit (see Fig. 13). However, most conditioners sold today exceed 6 amps full-load current. Of the 372 room air conditioner models listed in 1957 by the American Society of Refrigeration Engineers, only 11% were rated at 6 amps or less; hence the application of two or more units on the same circuit is more academic than practical and at most very limited. Many local codes avoid the complications of connecting conditioners to existing circuits and connecting more than one conditioner to the same circuit by requiring a separate branch circuit for each conditioner.

Multiple installations involving many room conditioners such as are frequently encountered in hotels, offices, etc., require careful planning to meet code requirements and yet minimize expensive branch circuit lengths.

How are the circuit calculations for such installations handled—as appliance circuits or motor circuits? Sections 4291, 4292 and 4293 appeared for the first time in the 1956 Code under the general heading, "Provisions for Air-Conditioning Units". Since these sections were added to Article 422—Appliances, it would be logical to treat air conditioners as appliances. However, in the same article, Sec. 4222 says, "Motor-operated appliances shall also conform to the requirements of Article 430", and "Every appliance shall be supplied by a branch circuit of one of the types specified in Art. 210". These statements provide room for conflict since the restrictions placed on conductor carrying capacity and branch circuit protection by Article 430 are treated differently than those of Article 210.

However, a logical approach to the problem which keeps in mind the intent of these provisions will in most cases resolve the confusing points to the satisfaction of all concerned. Since the manufacturer is required to supply the motor overcurrent protection, no problems should arise concerning the application of these devices. Safety considerations most likely to be in question involve the size of the branch circuit conductors and the rating of the branch circuit protective device. For larger units connected permanently to the distribution system, these can be treated using the provisions of Art. 430, as already discussed. For small plug-in window and through-the-wall units, UL has to some extent eliminated problems of branch circuit protection through the following requirement in its UL 484 Standard for Room Air Conditioners: "A unit which has an attachment plug cap rated not more than 15 amps which will not start and run in series with a 20-amp fuse; or a unit which has a 20-amp attachment plug cap which will not start and run in series with a 20-amp fuse . . . shall have a marking on the unit which indicates that time-delay fuses of the proper size are required."

Therefore, it may be assumed that a unit will operate satisfactorily on a standard fuse of the same rating as its attachment plug cap if there is no marking to the contrary on the unit. In any event, a time-delay fuse of the same or smaller rating could be substituted.

If circuit breakers are used for branch circuit protection, a 15-amp breaker will normally hold the starting current if a standard 15-amp fuse will, since such breakers have some inherent time delay. If the

unit is marked to require a 15-amp time-delay fuse and a 15-amp breaker will not hold the starting current, few inspectors will object to the use of a 20-amp breaker, since Article 430 permits such a procedure for motor loads.

Normally, starting problems are not severe with these units, since the low inertia of present-day motor-compressor combinations permits them to reach full speed within a few cycles. Such a rapid drop in starting current is usually well within the time permitted by the trip or rupture characteristics of the breaker or fuse.

Similarly, the question of wire size may be resolved by application of either Art. 210, 420 or 430. Rarely do room conditioners even as large as two tons take more than 13 amps running current, hence No. 12 conductors are more than sufficient. In addition, many local codes prohibit use of conductors smaller than No. 12. In localities where No. 14 wire may be used, provisions of Sec. 4293-1 restricting the loading to 80% of the circuit rating must determine the wire size, where "rating" is interpreted as referring to the conductor carrying capacity. If Art. 430 is used to determine the wire size, the 125% requirement of Sec. 4312 gives the same result.

The diagram of Fig. 14 shows one feeder of an installation involving many room conditioners which practically eliminates branch circuit wiring and will serve to illustrate circuit calculations for a multiple-unit installation. Total running current of each unit is 12 amps as shown; hence No. 14 wire could be used for branch circuit conductors, protected by a 15-amp fuse—either standard or time-delay. However, if the appropriate conductors of a 4-wire, 3-phase feeder were routed to the location of each conditioner and a combination fuseholder and receptacle installed as shown, the only existing branch-circuit conductors would be the jumpers between the feeder, the fuseholder, and the receptacles. These jumpers, then, could be No. 14 wire. Assuming that the fuse-receptacle unit is mounted directly on or in close proximity with the junction box in which the tap to the feeder is made, the No. 14 wire is justified from the fuse to the feeder since it is not over 10 ft long and is sufficient for the load supplied (Sec. 2434c).

Since both motors usually start simultaneously, the total unit current is used to compute feeder conductor size and protection. 125% × 12 plus 24 is 39 amps, permitting No. 8 conductors. However, this is practically the limit of the circuit's capacity; there is no provision for overload, and voltage drop is very likely to be a factor at the end of the feeder. Therefore No. 6 conductors should be used.

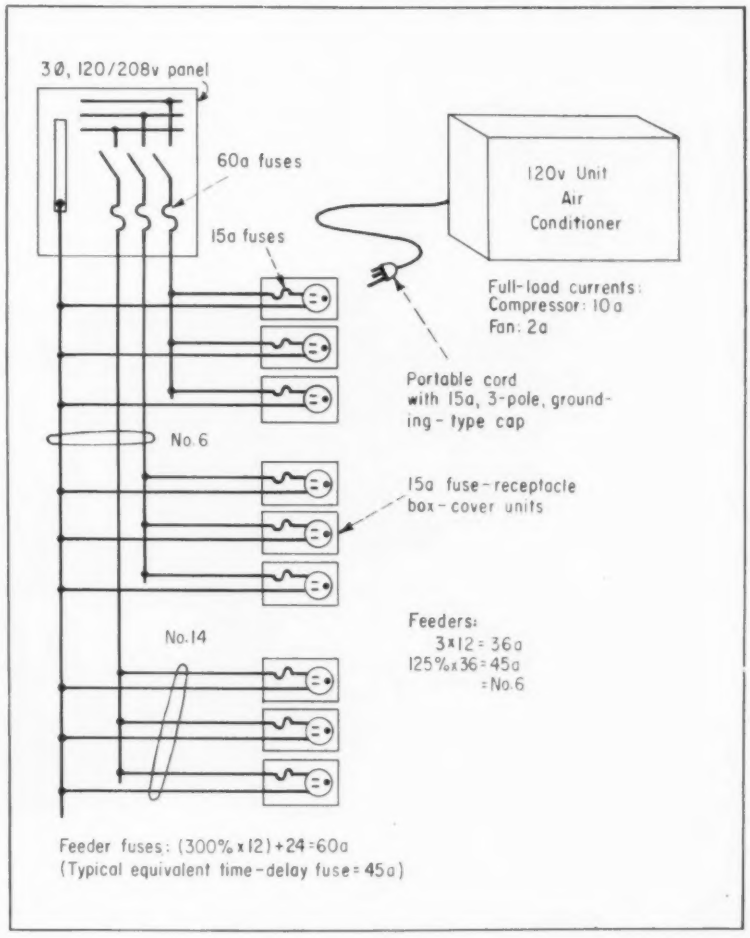
Feeder protection is calculated on the basis of 300% × 12 plus 24, or 60-amp fuses. Substitution of time-delay fuses for this 36-amp feeder load would likely permit 45-amp fuses, with a possible decrease in the required panel switch size, depending upon available ratings.

UL *Standards for Safety* 484 requires all cord-connected conditioners to have a green grounding conductor terminating in a fixed contacting member on the attachment plug cap. In addition, all conditioners are required to have provision for grounding all exposed noncurrent-carrying metal parts.

Thus the means for grounding the equipment is provided. But to date there is no all-inclusive code provision requiring conditioners to be grounded. Sec. 4292 requires a ground under certain specified conditions but does not recognize the danger of grounded metal radiators, water pipes, plumbing fixtures, metal shelving, metal ladders, gutters, downspouts, fire escapes, etc., that may be within reaching distance of the conditioning unit, despite their obvious hazard.

All indications, however, are that such omissions as well as the seemingly inconvenient arrangement of many of the code provisions affecting air conditioning wiring are being studied and, as experience in the field is assimilated, improvements will be affected which will solve the bulk of the problems which today beset contractors, engineers, inspectors and manufacturers alike.

FIG. 14. Room Conditioners on 3-Phase Feeder



Automotive assembly plant uses 7½ miles of . . .

Synchronized Conveyors

. . . and many new developments in electrical control to obtain high degree of automation for mass production.

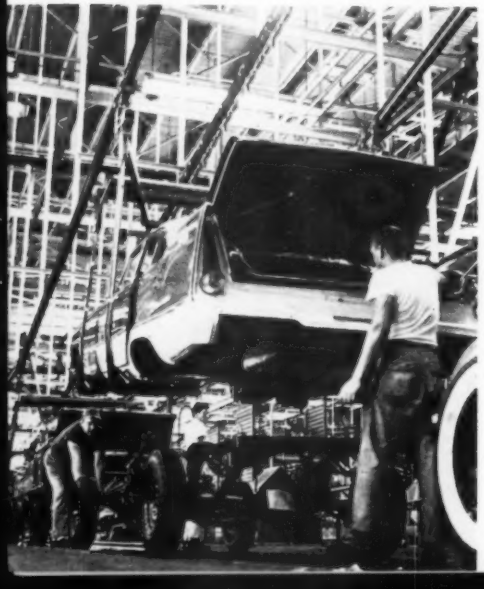
By G. E. Mathias, *Systems Control Department, Westinghouse Electric Corp., Buffalo, N. Y.*

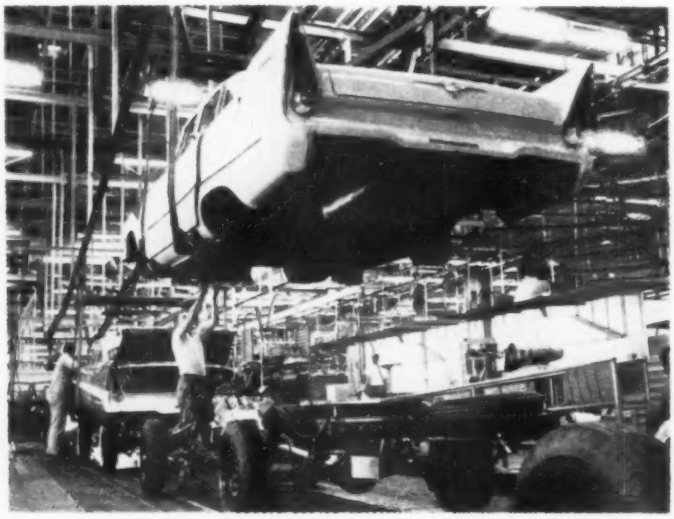
ONE of the most fully automated plants in the automotive industry is the Chrysler Corporation's Plymouth assembly plant at Newark, Del. Engineered to reduce manual material handling to a minimum, the plant contains over five miles of overhead monorail conveyors and an additional 2½ miles of floor-type conveyors which are electrically synchronized to travel in unison. In addition, transfer of body trucks from one conveyor to another is entirely automatic, while even transferring a truck from the normal assembly line to other lines for inspection or repair can be accomplished by pushing a button.

Regulation and operation of these conveyors is by intricate control systems, the heart of which is a magnetic amplifier control that synchronizes and regulates conveyor speed and position. Each conveyor drives a polyphase synchro-tie transmitter which transmits an accurate position signal to the control, the first signal being compared with a similar electrical position signal generated by a master synchro-tie driven by a second conveyor or by a zone master rate synchronous drive. Conveyor dogs spaced approximately 16 to 18 ft apart along the conveyor chain are thereby controlled to meet (within one inch) the corresponding dogs on a second conveyor, insuring safe, dependable transfer of a body truck from one conveyor to the next.

Each conveyor is driven by one, two, or three dc motors, all powered from one adjustable-voltage generator. Selected control equipment complements motor characteristics so that each motor assumes its proper load; this load being primarily determined by the conveyor configuration and the location of each drive in the conveyor system. The motor-generator set and the control equipment for each conveyor are packaged as a factory-assembled and prewired a-v drive.

DELIVERY OF COMPONENTS must be carefully timed, with overhead conveyor delivering body shell and parts as synchronized floor conveyor carries chassis into position. Conveyors in Chrysler's Newark plant approximate 7½ miles, while total area of plant places 1½-million sq ft under a single roof.





BODY SHELL DROPS down inclined dual-track conveyor onto chassis moving along final assembly line. With the latest conveyors and controls installed in this plant, it has become both a proving ground and a showcase for future production techniques designed by this automotive company.

Generator excitation is by magnetic amplifier, which is ideally suited for this application since it is a static, nonelectronic amplifier built from components that require practically no maintenance. Also, use of these components means that no warm-up time is necessary, while high resistance to shock and vibration is provided.

A good speed regulator is an excellent foundation upon which to build a position regulator, since position is equivalent to the time integral of speed. As the speed of the drive approaches the desired speed, the position regulator will be called upon to correct a decreasing position error. For this reason and for reasons of flexibility, the magnetic amplifiers on these conveyor drives have counter-emf speed feedback.

In certain conveyor locations where it is neither necessary nor desirable to maintain absolute position synchronization, no position error signal is supplied, although the regulating system otherwise remains essentially the same. Should a need arise for any normally synchronized conveyor to be operated temporarily on an independent but controlled basis, a control switch removes the position signal input and converts the regulator to a speed regulator. A speed-adjusting rheostat permits selection of any speed within the normal range of the drive.

On some conveyors when an operator momentarily stops the drive, the position-reference signal which comes from some other source continues to advance. When he starts the drive again, the position error may be large. It is not desirable to permit the drive to overspeed excessively while attempting to regain position. An error limit system holds back any large position-error signal that is greater than that required to obtain a 10% change in base speed of the conveyor. Normal signals are unaffected and the extent of error limit is readily adjustable.

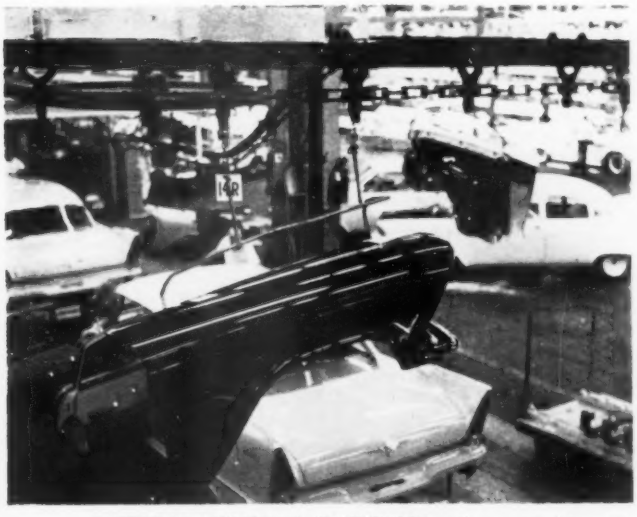
Geared Synchro-Tie Transmitters

The polyphase synchro-tie transmitter driven by each conveyor is geared so that one revolution of the synchro-tie is equivalent to one job length on the conveyor. (For this application, synchro-ties are 2-pole machines.) If 4-pole synchro-ties had been selected, the gearing would have been provided so that two job lengths were equivalent to one revolution of the synchro-tie. Gearing the polyphase synchro-ties in this manner eliminates the possibility of false synchronizing location. There is only one correct position and the regulating system unerringly directs the drive to that position by the shortest route.

Primaries of the synchro-ties are excited from a common 3-phase power supply. A voltage is induced in the secondary winding by the rotating magnetic field established by the primary winding. The phase relation between primary and the secondary voltages depends upon the rotor position of the synchro-tie.

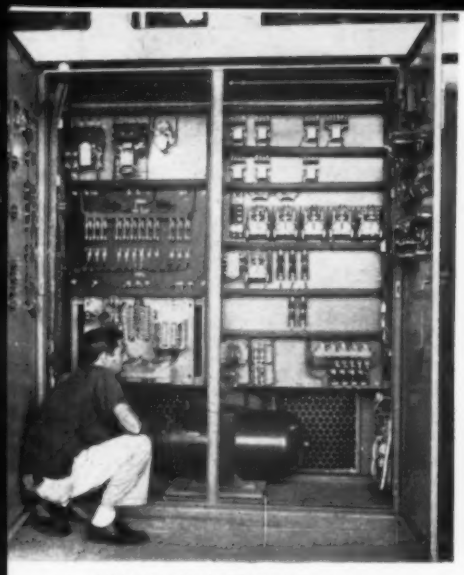
One of the indicating instruments on the front door of each conveyor a-v drive cabinet is a synchroscope that indicates the instantaneous relative position of the conveyor with respect to its master position reference. Since an electrician can look at the synchroscope and detect at a glance any variation in performance, he is actually better informed as to the accuracy of synchronization than personnel on the assembly line. A trimming adjustment is available if the electrician should desire to make adjustments.

The conveyor drives are complete with electromechanical safety devices to prevent destruction of drive equipment or work in progress should an accident occur. When overloads, jammed conveyors, broken conveyor chains, and off-track conditions are sensed by the control equipment, it promptly stops the drive and indicates by signal light the cause and location of the trouble. Unscheduled down time is minimized because trouble locations are pinpointed, even on long-winding conveyor runs. Checks

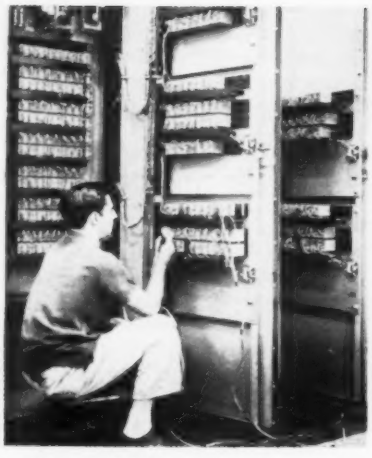


OVERHEAD MONORAIL CONVEYORS deliver such things as fenders, doors, deck lids, hoods, wheels, cushions and seats to proper location at exact time. Thus the emphasis is upon proper scheduling, efficient movement of materials and products, and efficient handling of materials.

FLOOR TYPE CONVEYORS convey bodies and chassis from one production center to another, such as through this metal-finishing area. Assembly of parts involves extensive use of electric hand tools. Note inclined lighting troughs to direct light inward toward moving bodies.



HEART OF ELECTRICAL intelligence system, synchronizing each conveyor with its lead conveyor, is a magnetic amplifier designed to regulate conveyor speed and position (lower left).



CYPAK CONTROL related to temporary storage of car bodies transmits selection information an additional step forward, in parallel with a waiting space on the transfer conveyor, each time the conveyor indexes. Cypak logic elements consist of networks of magnetic cores, rectifiers and resistors. In this photo Cypak modules are being tested during installation period.

on the position-regulating system are made automatically; if a position error above the tolerance band occurs, the conveyor will stop and postpone transfer until it is safe.

It is a common practice in the conveyor industry to set the instantaneous overload relay close to the actual motor-running current in order to quickly detect a conveyor jam. Since the accelerating current will be above this setting, it is necessary to bypass or short the instantaneous overload relay during acceleration. This is a critical period for the entire system should an attempt be made to start with a jam not cleared. However, on this drive dual-calibration, instantaneous overload relays provide full protection. One setting is made slightly higher than normal accelerating current and a second slightly higher than normal running current. An auxiliary coil automatically recalibrates the relay for normal running conditions, once the accelerating period is past. A second overload relay provides thermal overload protection in the conventional manner.

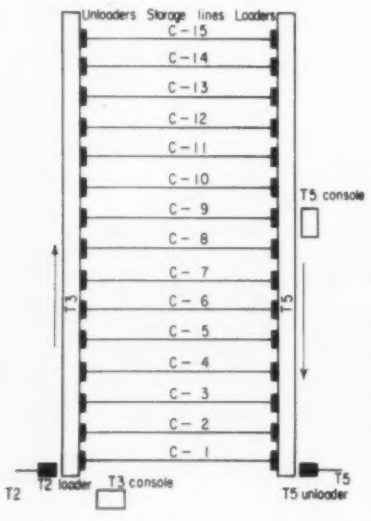
Cascade-type electrical interlocking is used wherever a series of conveyors are running together. Any normal or trouble stop on one conveyor will stop the conveyor feeding into it, which in turn stops the next conveyor in line. Thus, no pile-up will occur if a conveyor attempts to feed a dead conveyor. After the first conveyor is restarted, the second conveyor will automatically restart, followed by the third and all others. The responsibility for starting and stopping conveyors is removed from the operator and transferred to the electrical equipment.

Conveyors in storage areas are isolated from direct synchronism with production line conveyors, while routing and scheduling in the storage lines are simplified by use of Cypak logic elements. The Cypak control directs the proper indexing of transfer, quick-loader, and storage conveyors.

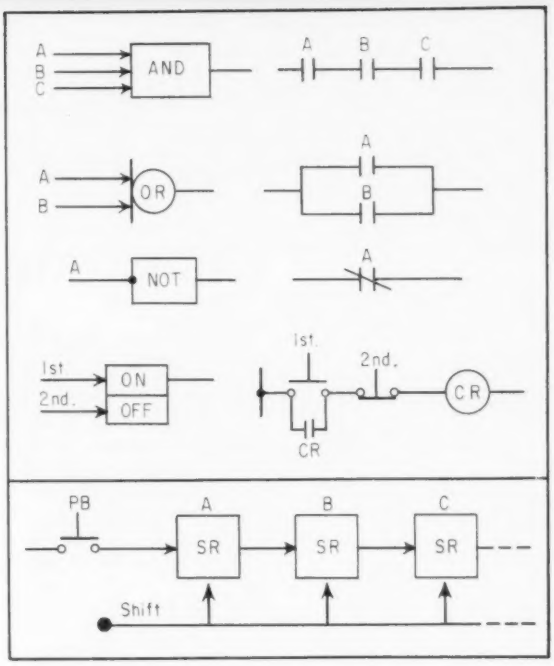
Of particular interest is the manner in which commands are stored and then "read" at the appropriate time. This is accomplished by arranging Cypak logic elements into a pattern of "shift register" stages.

Cypak was selected for the memory storage system because it, like magnetic amplifiers, is entirely static and essentially maintenance free. No magnetic tapes, paper tapes, punched cards, or vacuum tubes are required; this greatly increases the reliability of the system.

Manual material handling is con-



ROUTING AND SCHEDULING of auto bodies into and out of storage is simplified by use of Cypak logic elements. In this diagram, bodies arrive on loader T2 from transfer conveyor. Operator at console T3 selects suitable storage line for body by depressing pushbutton, initiating indexing cycle whereby body travels along conveyor T3 to its indexed storage line, then is automatically transferred to it. Initiating commands are retained by Cypak control. Similarly, when bodies are withdrawn from storage, operator at console T5 selects in sequence the bodies which are to re-enter the synchronized conveyor system. These selections (15 index locations ahead of the actual delivery of the body into the system) are made by depressing proper pushbuttons. Cypak transmits selection information in parallel with waiting vacant space on T5 transfer conveyor, and, when vacant space is in alignment with selected storage conveyor, the unloader takes one body from proper storage line and places it on T5 transfer conveyor.



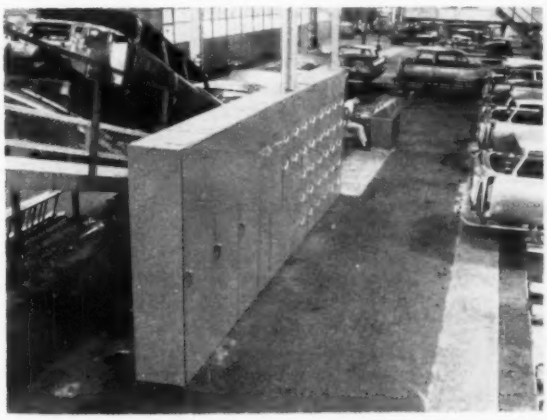
CYPAK LOGIC ELEMENTS consist of networks of magnetic cores, rectifiers and resistors; therefore are static, long-life components in relation to electromechanical relays. The four basic logic functions are "and", "or", "not" and "memory", as shown here schematically. For "and" function, an output results only when **all** inputs are received, corresponding to relay contacts in series. For "or" function, an output results when **any** input is received, corresponding to relay contacts in parallel. For the "not" function, an input results when there is **no** input, corresponding to normally closed contact of a relay. For the "memory" function, an output results after a **first** signal input is received. This output remains on after the first signal input is removed. When the **second** input appears, the output disappears. Thus the unit "remembers" the first signal until the second signal appears. This corresponds to a sealed-in relay LVP circuit. Commands are stored and "read" at the appropriate time by arranging Cypak logic elements into a pattern of "shift register" stages. When in use in the plant under discussion, unloading operations are initiated when code for any particular conveyor reaches its station. Provisions also exist to rescind any order, no matter how far along it has progressed in the system, and a manual cycle then permits the operator to load an auto body semi-automatically.

tinually being reduced by modern electrical control equipment, while electrical control equipment is also replacing the human element in memorizing locations of work in temporary storage and in transit. Increased production and improved quality are immediate benefits.

With advances being made in processing equipment in the automotive assembly operations, it is increasingly important that conveyor equipment be so designed that there will be completely smooth operation of the conveyor, with no running ahead or dropping back to catch up or fall in line as is the case at present. Automatic spray equipment, for example, will not produce a satisfactory job if the part being sprayed is not always moved at the same rate past the spray equipment. There is, perhaps, no other industry in which continuity of operations is so important as in the automotive assembly field. Within a matter of minutes, the stopping of one operation will shut down the entire plant, so it is imperative that all equipment be as reliable as possible, and that limit switches, which play a very important part in our operations, be of the most rugged construction possible.

The assembly of automobiles is an operation that is unique in that it requires little machinery for changing the physical characteristics of the parts. Except for welding and painting, the operation consists of transporting parts from receiving areas to points of assembly and there assembling the parts, using principally electric and air-operated hand tools. Thus the emphasis is upon proper scheduling and efficient movement of materials and product.

OPERATOR AT CONSOLE (T5 in accompanying diagram) depresses proper pushbuttons to select in sequence the auto bodies which are to be withdrawn from temporary storage (background) and re-enter the synchronized conveyor system which will carry the bodies to the paint lines.



FROM THE EXIT END of 15 storage conveyors, bodies are selected for automatic deposit on a main floor conveyor. Power capacity in plant is 15,000 kva, of which 6000 kva is available for welding operations. Control centers facilitate convenient operation of major motors in operation.

San Francisco office building . . .

Designed for Efficiency, Convenience and Comfort

IMPRESSIVE ADDITION to growing list of outstanding San Franciscan commercial structures is new headquarters for the Fireman's Fund Insurance Company. Constructed on high ground overlooking the city, this building features a progressive lighting installation, year-'round air conditioning, 12-kv utility service and 480/277-volt distribution for combined service of power and lighting requirements.

. . . combines modern electrical system with complete air conditioning, hi-fi PA system and earthquake-resistant construction. Electrical features include prize-winning lighting, motor-control centers, wide variety of distribution mediums, five substations, drawout switchgear and underground 12-kv primaries.

MOST recent addition to San Francisco's commercial picture is an imposing headquarters building constructed by the Fireman's Fund Insurance Company. Smartly modern in concept and design, this structure owes much of its prestige to a national survey that sifted and gleaned scores of top-flight ideas related to office convenience, efficiency and comfort. The result overlooks practically nothing which might contribute to employee welfare.

Hillside-situated with the heart of the city in view, yet harmoniously blending with the character of a residential suburb, the sprawling 3-level structure includes a 400-seat cafeteria, sheltered terrace for relaxation, reading and game rooms, two lounges, ample parking space and the "last word" in office facilities. It also combines pleasing color motifs with earthquake-resistant cantilever construction; full air conditioning; unique lighting designs that provide glareless illumination while maintaining ideal brightness ratios; 12-kv primary underground routing to five substations; 480/277-volt secondary distribution to supply power and lighting demands; drawout switchgear equipment for safe and easy operation and maintenance; control centers for convenient motor operation, and IBM data-processing machines that make mathematical decisions with fantastic split-second speed.

Special merit pertains to general lighting in two virtually-unpartitioned office areas (totalling 87,500 sq ft; equivalent to two football fields) where brightness ratios are below 3-to-1 and where eye comfort is insured through the judicious combination of diffusing with shielding mediums. In these areas light is provided by 8-ft standard cool white slimline T-12 lamps installed in continuous rows on approximate 2-ft centers. Diffusion is obtained by installing self-supporting curved translucent rigid bakelite vinyl troughs beneath all lamps. Shielding takes the form of metal eggcrate louvered panels suspended beneath the entire lighting installation. And, since the shielding angle of the 3- by 3-in. eggcrate cells is greater than the unshielded arc existing above edges of diffusing troughs, it is asbsolutely impossible to see a bare lamp from any normal viewing angle or floor location.

Since diffusing panels have a 65% reflectance factor (with 35% light transmission), a high degree of interflection takes place within the plenum, resulting in overall brightness values which are consistently uniform. In addition, to promote visual comfort still further, considerable attention was directed to overall environment color and reflectance values, with grey floor tiling and green walls having reflectance factors of 37%, tan furniture and grey desk tops having 40% RFs, and white acoustical ceiling panels (installed beneath girders and wall shoulder borders) with RFs of 80%. After six weeks of use this lighting installation (utilizing 1400 lamps operating at 277 volts and 430-ma, and constituting a 140-kw total electrical load) produced 72 footcandles at desk-top levels.

Still other advantages related to

LARGER THAN A FOOTBALL FIELD, this unpartitioned office area maintains a 3-to-1 brightness ratio while providing unusually comfortable seeing conditions. Design of lighting plan resulted from national survey to analyze variety of clerical seeing tasks, plus construction of a full-scale mock-up whereby problems were faced and solved prior to manufacturing and installation periods.

RANDOM PATTERN of coral-colored louvered panels interposed among the standard white units in this bright cafeteria lends colorful variety and visual interest to the large-area lighting plan. Parallel bands of acoustical panelling mark location of ducts, pipes and joists. All-glass walls and doors open onto broad flagstone terrace that offers panoramic view of the Golden Gate area.

this "diffused eggcrate" combination include open-plenum flexibility for functionally locating air-supply diffusers and return grilles, ventilating ductwork, sound-system loud-speakers and similar mechanical equipment without having to consider exact spacing or appearance patterns. These elements (as well as structural beams, piping and lighting-system components) are concealed from normal view.

The high quality of this lighting installation was no chance accident, for it resulted from a nation-wide pre-design survey to determine exact insurance-office activities and lighting requirements; the subsequent creation of a full-scale mock-up to experiment with various lighting concepts and materials, thereby detecting and correcting problems prior to actual manufacturing and installation stages; working out construction and wiring details during this preliminary and precautionary period, also measuring and evaluating flux brightnesses and system effectiveness for the many seeing tasks being considered (bookkeeping, filing, typing, clerical and general paper work).

This investigation also resulted in the design of a special steel ballast housing to improve heat dissipation; providing special bottom cover sections to insure against possible ballast leakage; devising simple methods for removing diffusing and shielding elements to expedite maintenance; locating central panelboards near elevator shafts to simplify control, circuiting and testing, and in developing special fixture-holding brackets which were secured to overhead concrete joists by means of threaded steel powder-driven studs.

Prize-Winning Lighting

The lighting plan was selected as a prize-winner in the 1957 International Lighting Competition. The designers were: architect Edward B. Page; Dan M. Finch, Professor of Electrical Engineering at the University of California, and John Walsh, Chief Illuminating Engineer for the Pacific Gas and Electric Co. Metal louvers for the installation were manufactured and installed by United Lighting and Ceiling Company (a Schwartz & Lindheim subsidiary), while wiring and controls were installed by electrical contractors Ets-Hokin & Galvin in accordance with the overall electrical design developed by consulting engineer Clyde E. Bentley.

Incidentally, in some areas (such as the 400-seat cafeteria), this same basic wide-area illuminating medium is given variety and added interest by inserting numerous coral-toned 2- by 2-ft eggcrate louvered sections in random pattern among the standard white-louvered squares. Coral is likewise used on walls and columns, while chairs and tables combine coral with yellow, black and white to create a warm, bright and cheerful environment.

In other sections of this new building, lighting is obtained through the judicious use of such conventional mediums as ornamental bowl-shielded high-wattage filament lamps beneath 2-, 3- and 4-ft white ceiling-recessed domes (used in some executive offices, plus a lounge and dining room); concentric-ring fixtures mounting 300-, 500- and 750-watt silvered bowl lamps (installed in a small auditorium); various combinations of 2- by 2-ft luminous panels beneath fluorescent lamps, plus several unique specially-created luminaires of an ornamental nature.

In connection with the 2- by 2-ft luminous panels, it should be added that these luminaires are variously recessed, semi-recessed or surface-mounted; variously equipped with a single or double diffusing planes; variously arranged in combinations that result in overall illuminated areas ranging from 2- by 8- or 4- by 4-ft elements up to 10- by 10-ft squares; variously equipped with flat, corrugated or otherwise-patterned bottom diffusing plates, and generally hinged in 2- by 4-ft sections to provide access to reflection cavities for cleaning, relamping and maintenance.

Distribution at 12-KV

Distribution of power at the primary level of 12-kv is underground from the base of the utility's terminal pole through service entrance and main switchgear to five substations where current is stepped to utilization levels of either 480/277-volt (to supply motor control centers, air conditioning and fluorescent lighting) or to 208/120-volt (for office, kitchen and data-processing equipment plus incandescent lighting). Of the five substations, two with a combined

COOL WHITE SLIMLINE LAMPS on 2-ft centers are used to illuminate 87,500 sq ft of general office area. Lamps operate at 277 volts and 430 ma and are supported by sockets incorporated in cross channels that also contain high PF ballasts. Note acoustical material on underside of overhead slab. After lamps and wiring are installed. . . .

CURVED TRANSLUCENT SHIELDS are placed beneath all lamps, thereby providing high degree of shielding plus 65% upward reflection to cavity of plenum. Shielding panels are self-supporting rigid bakelite vinyl, supported only at ends by lipped brackets seen more plainly in previous illustration. After shields are in place. . . .

EGGCRATE LOUVERED PANELS are supported by inverted T-bar grid. Since shielding angle of eggcrate cells is larger than unshielded arc remaining above side lips of diffusing troughs, direct glare from a bare lamp is an impossibility. Note placement of air conditioning ducts and loudspeakers above louvered panels and between shielding troughs.

rating of 1750-kva supply 480/277-volts while the remaining three with a total rating of 1225-kva take care of the lower-voltage requirements.

Primary cables are ungrounded single conductors of concentric stranded paper-insulated oil-impregnated lead-covered neoprene-jacketed construction. They are carried underground or beneath the building's basement slab through banked concrete-sheathed asbestos-cement ducts, with changes in direction occurring only in multiple-compartment integrally-cast reinforced-concrete handholes that also accommodate control and telephone wiring. Said handholes are complete with angle iron frames and non-slip steel covers, pulling irons and cable racks, hooks and insulators, copper-encased steel ground rods and copper alloy ground clamps.

Floors of handholes slope towards French drains, while end-belled duct-banks slope towards handholes for proper drainage. Underground ducts are maintained at least 18 in. below ground level and, where they sweep upwards through interior floorslabs to enter high-voltage switchgear and substation vaults, they do so via suitable adapters and steel ells.

MOTOR CONTROL CENTERS such as this are located in five different areas where heavy load concentrations exist. Substation at right steps current from 12-kv to 480Y/277 volt while related dry-type control transformer re-steps voltage from 480 to 120. Combination starter units are removable and interchangeable, and operating handles of all switches and breakers are interlocked so that cubicle doors cannot be opened unless handles are in "off" positions.

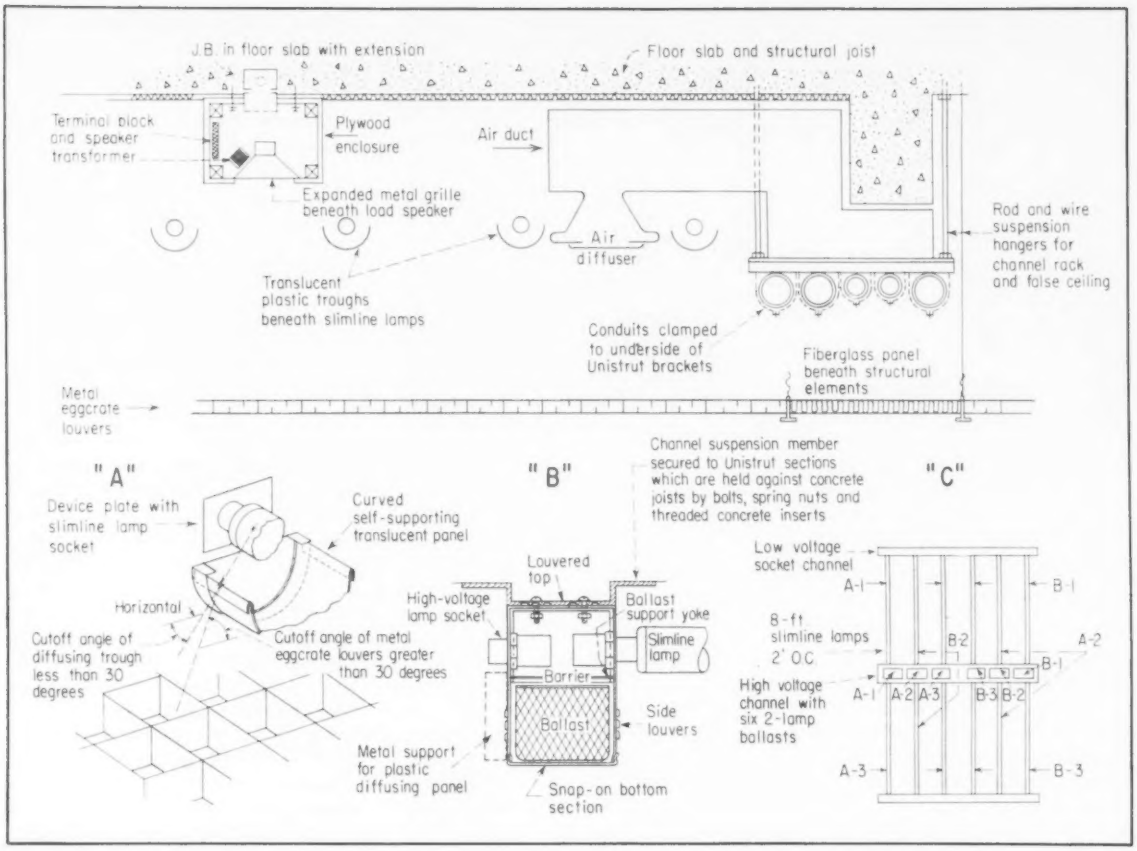
Five Substations Plus

As to primary substations and switchgear, primary cables enter these units from below via single-conductor potheads and wiping sleeves.

High-voltage breakers contained therein are all drawout vertical-lift assemblies equipped with 120-volt dc closing and tripping solenoid mechanisms. When these breakers are lowered from their connected positions for removal or testing, safety shutters automatically close entrances to primary disconnects, while mechanical interlocks are likewise provided so that breakers can leave connected positions only when in open-circuit positions.

Primary interrupter switches are air-filled 15-kv units interlocked with secondary main breakers; the fuses protecting individual transformers being coordinated with primary feeder breakers so that, should any transformer fail, only those fuses associated with the faulty transformer would open, thereby leaving primary breakers unaffected.

All substation transformers are Pyranol filled, with 12-kv 3-phase



SPECIAL OFFICE LIGHTING is here detailed to indicate relative placement of lamps, translucent diffusing troughs, metal louvered shielding medium, air ducts and diffusers, loudspeaker enclosures, acoustical blanket on underside of overhead slab, beams and conduits. Auxiliary sketches show arrangements of (A) lamp sockets and diffusion panel brackets, (B) ballast channel and (C) typical circuiting. In latter sketch, letters denote circuits while numbers denote phases. Eight other circuit arrangements were used to connect other numbers, lengths and groupings of lamps.

3-wire delta primaries and with either 480/277- or 208/120-volt 3-phase 4-wire secondaries. High-voltage windings are fitted with manual voltage changers related to four taps; two 2½% steps being positioned above and below normal-voltage connections in each instance. Voltage changers, mounted externally, may be operated only when transformers are deenergized.

At all substations, construction of switchgear cubicles is metal-clad. Spare low-voltage breaker compartments provide for adequate load growth. Low-voltage breakers are manually-operated draw-out units. And 120-volt dc power for operating high-voltage breakers is supplied by 60-cell lead-antimony batteries mounted on earthquake-resistant racks and rated for a 1-minute discharge of 144 amps.

Aside from transformation of current at the five substations just discussed, additional local power requirements are supplied by dry-type step-down or step-up transformers having either 480-volt primaries and 208/120-volt secondaries, or 208-volt primaries and 480/277-volt secondaries. In both cases, primaries are 3-wire while secondaries have a grounded neutral. Primary windings, similar to the larger substation units, are likewise equipped with four voltage-changing taps. And transformers are supported by shock-absorbing vibration-insulating mounting brackets.

Wide Variety in Wiring Mediums

Distribution mediums used to carry power from local panelboards to points of ultilization reveal wide variety, for wiring is carried beneath floors via (a) dual-cell metallic ducts, (b) trenches or (c) depressed-slab cavities; through or beneath floorslabs (in suspended-ceiling plenum chambers) via (d) conduit, and up through the building (from underground ducts to roof-based penthouse) via (e) banked risers that serve tierred electrical closets on the various intervening floors (see related illustrations for details).

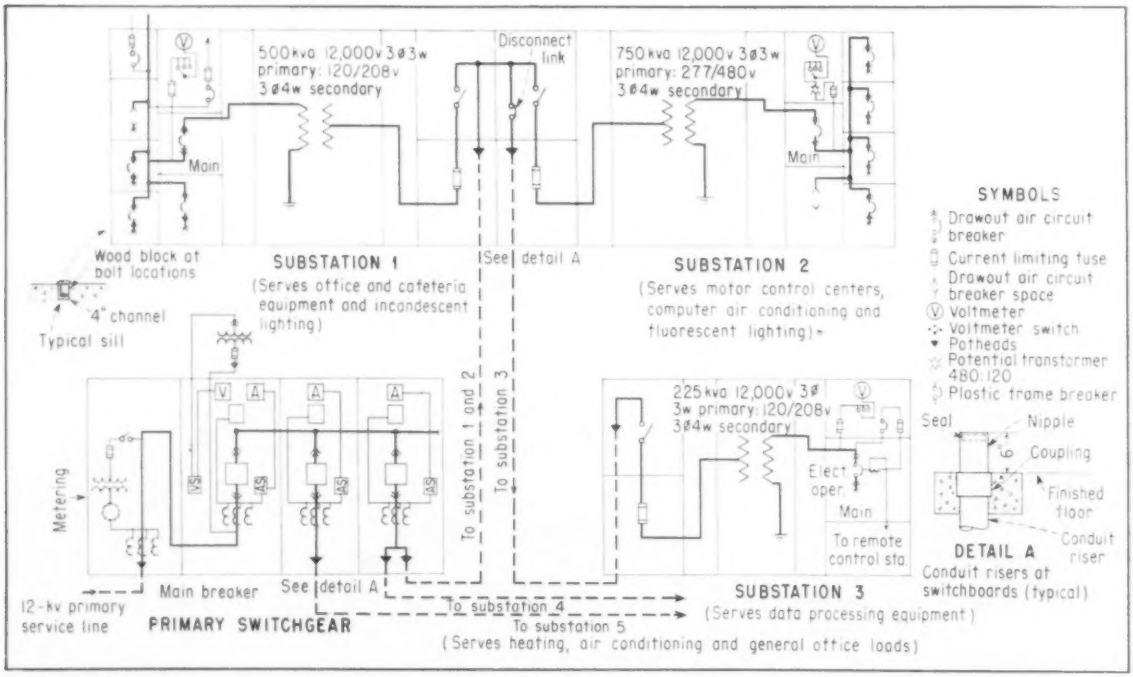
Variety exists even within these several individual categories, for (a) underfloor dual-cell (power plus telephone) metal ducts have friction-type inserts that vary in height from 1 in. (where ducts are parallel to joists) to 2½ in. (where ducts are placed at right angles to joists), while (b) conduit installations incorporate numerous variations in hanger and clamp arrangements, plus special pull- and junction-box construction features (again refer to detailed sketches).

As insurance against possible errors in locating circuits, making connections or operating equipment, all electrical components and

PRIMARY SWITCHGEAR (right rear) and three unit substations located in common vault are interconnected by underground duct banks. Substation directly opposite 12-kv switchgear steps power to 480/277-volt level for fluorescent lighting, motor control centers and air conditioning, while other two subs (foreground) furnish 120/208-volt power for office and cafeteria equipment, incandescent lighting and data processing equipment. Two additional substations located in other parts of the building bring capacity total to 2975-kva.

wiring mediums in the building are positively and distinctly identified. For example, engraved laminated bakelite plates are securely screwed to frames of all apparatus; descriptive nameplates identify all control devices such as motor disconnects, convertible circuit breakers, panelboards and cabinets, telephone terminals and volume control stations; while all exposed conduits are plainly color-coded with 4-in. bands of identifying color applied at least once for every 20 ft of length. In this coding process, yellow identifies 480/277-volt feeders and branch circuits, orange marks 208/120-volt wireways, white is related to control circuitry, brown identifies telephone wiring, silver locates public-address conduits and black marks grounding channels. Each distinctive band is emphasized by 6-in bands of green applied on either side of it; this consistent treatment leaving little likelihood for erroneous identification.

To facilitate control of motors located in areas of concentrated load, five motor control centers suitable for 480-volt 3-phase 3-wire application are strategically situated. These centers are constructed with common horizontal buses to distribute utilization current, and are equipped with 480/120-volt dry-type control transformers having four 2½% taps, all of which are on the high side of the rated-voltage connection. Of the five centers, four have circuit breakers with minimum ICs of 15,000-amps RMS at 480 volts, while the remaining unit is equipped with fused switches with 25,000-amp ICs. Operating handles of switches and breakers are so interlocked that their cubicle doors may not be opened unless handles are in "off" positions. Starter units, removable



PRIMARY BREAKERS are removable, electrically-operated and so interlocked that they may be lowered from their connected positions only when in open-circuit status and segregated from primary disconnects by automatic safety shutters. Low-voltage breakers are also draw-out but manually operated. Construction of all switchgear is metal-clad with connections to underground primaries effected via single-conductor potheads.

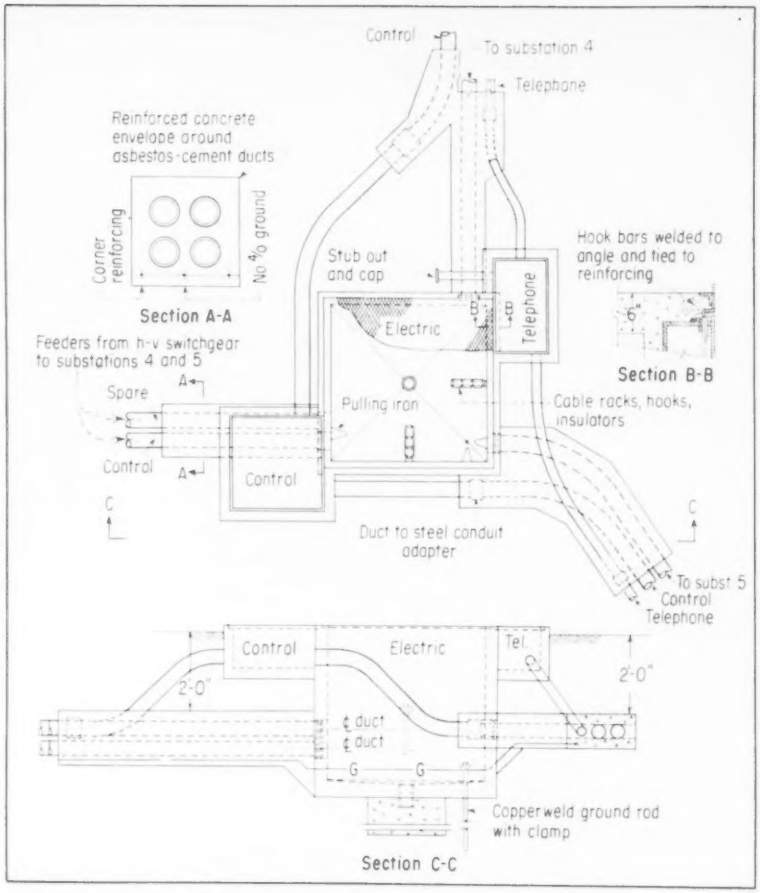
and interchangeable, are combination-types; their motor and control leads being brought down to master terminal boards located at the base of metal-clad vertical sections making up each control center. Sections are so constructed that control units may be readily removed or added as required, while cubicle doors serve as mounting panels for all control switches, pilot lights and pushbuttons related to the coil circuits of the various starters.

While the majority of motors in the building are located in areas of concentrated load and are therefore controlled centrally as was just discussed, many other segregated motors have individual starters. As a result, power circuits for the various motor installations show considerable variety; extending either directly from control centers or panelboards to the motors, or travelling to them via intermediate disconnect switches, magnetic or manual starters. Control methods likewise vary; incorporating numerous relays and miscellaneous electrical devices. It may also be added that all 480-volt motor and control connections are by means of flexible conduits, with additional bare copper ground wires (No. 12 minimum for motors, No. 14 for control devices) contained therein.

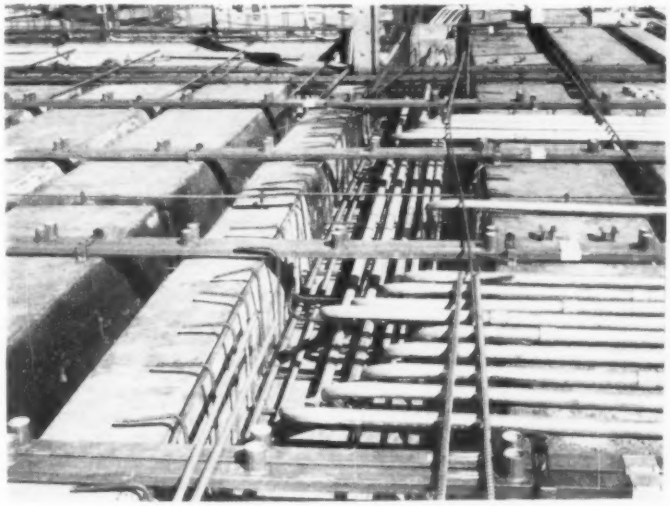
Unique in construction, this Z-shaped hillside structure utilizes concrete floor slabs that extend from a structural core 40 ft outwards to building columns, then 15 ft further to cantilever-supported all-glass curtain walls, then 3 ft still further to provide sun shielding. The building core (measuring 150 by 34 ft and framed by 14-in.-thick bearing walls) serves the dual purpose of stabilizing the structure against possible earthquake shocks while housing elevators and other service facilities. Steel columns are unusual in that they consist of twin 6-in. channels; the space between them being filled solidly by filler plates to form laminated 6- by 17-in. cross-sections, with high-strength bolts tying these masses together.

Where exterior walls are not of glass, they consist of metal panels backed by asbestos-cement board, glass-fiber insulation and perlite plaster.

Air conditioning is likewise unusual in that two separate areas are considered; interior bays being served by a double-duct hot-and-cold-air system, with blending tak-

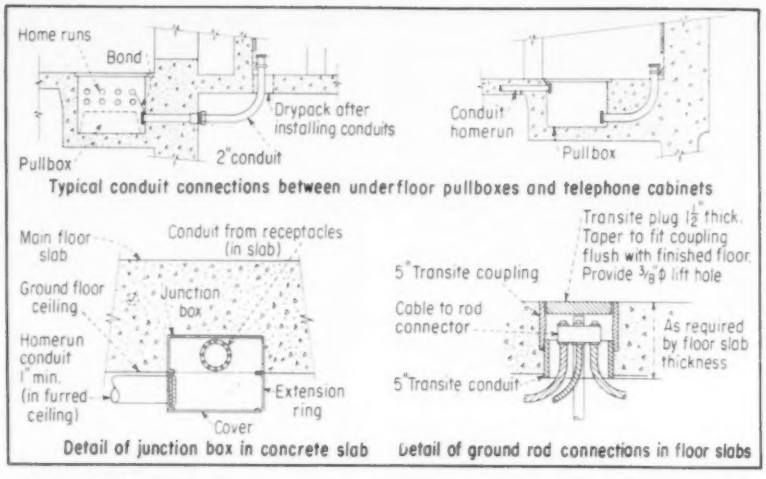


DISTRIBUTION of 12-kv power is underground through concrete-sheathed asbestos-cement ducts. Changes of direction occur only at triple-compartment handholes designed to incorporate separate control and telephone cubicles in these integrally-cast assemblies. Handholds, complete with non-slip steel covers in angle-iron frames, are equipped with necessary cable racks and insulators, pulling irons and hooks, sump drains and grounding rods.

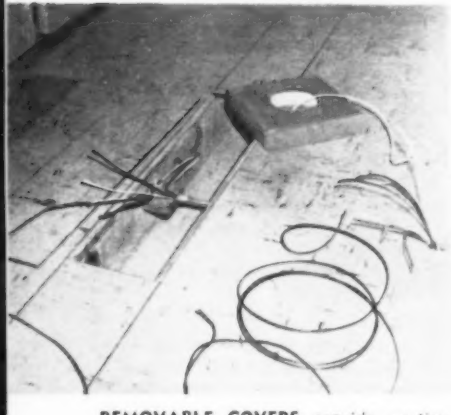


INSTALLATION VIEW shows mass of dual-cell 2-level underfloor ducts banked home runs placed in beam cavities prior to pouring of concrete, integrally-cast pull-boxes (upper center) and pattern of steel floorslab pans, reinforcing rods and duct saddles.

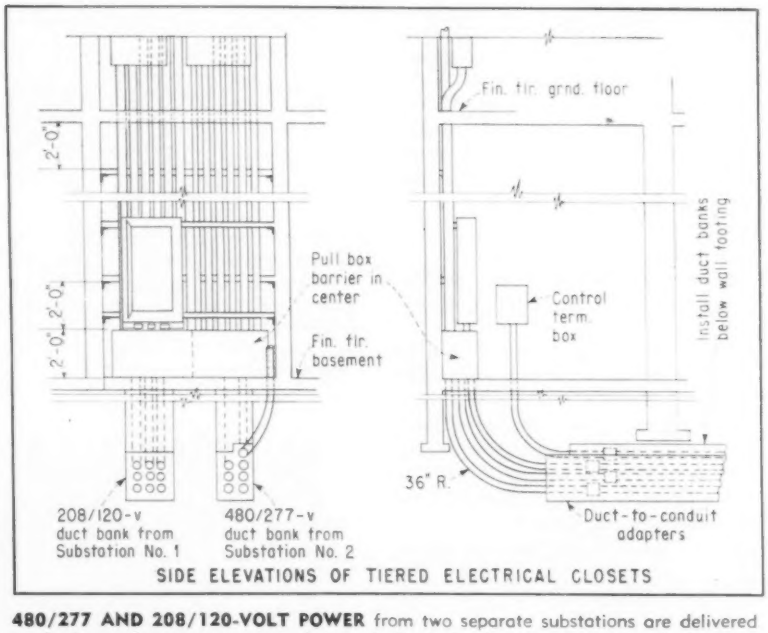
UNDERFLOOR DUCTS with inserts on 2-ft centers provide power and telephone connections for all possible locations in general office areas. Maximum of five duplex 120-volt 15-amp grounded receptacles are carried on each No. 12 circuit.


Home runs
Bond
Drypack after installing conduits
2" conduit
Pullbox
Conduit homerun
Pullbox
Typical conduit connections between underfloor pullboxes and telephone cabinets
Main floor slab
Ground floor ceiling
Homerun conduit 1" min. (in furred ceiling)
Conduit from receptacles (in slab)
Junction box
Extension ring
Cover
Detail of junction box in concrete slab
Transite plug 1½" thick. Taper to fit coupling flush with finished floor. Provide ⅜" ϕ lift hole
5" Transite coupling
Cable to rod connector
5" Transite conduit
As required by floor slab thickness
Detail of ground rod connections in floor slabs

LARGE-RADIUS SWEEPS, with conduit contained either partially or wholly within structural concrete members of building, connect underfloor pull-boxes with related panelboards or cabinets. Conduit routing also utilizes special junction boxes with extension rings protruding beneath slabs, while Transite conduit sections, couplings and tapered plugs were used to provide accessible-yet-protected cavities for ground-rod connections.



REMOVABLE COVERS provide continuous access to floor trenches which are cross-connected to one another by means of 6-in. diameter Sonotubes. Pull-boxes contained within trenches are hot-dipped galvanized with six concentric KOs in each end.



480/277 AND 208/120-VOLT POWER from two separate substations are delivered to the base of a common, central riser shaft via banks of concrete-sheathed underground ducts and large-radius conduit ells. Installation incorporates large pull-boxes with central barriers, frequent channel supports for risers and closet panels, liberally-sized wiring enclosures, plus spare ducts, risers and breaker positions to permit future growth.

UNOBSTRUCTED CAVITY existing between joist-supported flooring and underlying depressed concrete slab provides maximum flexibility for connecting IBM data-processing machines in office area where such equipment is concentrated.

ing place in the central core and distribution being handled by four central diffusers; and with exterior bays served by separate under-window units. Ducts related to the air conditioning system are carried beneath structural slabs and, where they traverse girder lines, each girder is suitably reinforced with three 10-in. I-beams.

To conclude with several indications of size, it may be stated that the gross floor area of this impressive 3-level structure is equivalent to that of a 20-story 100- by 100-ft skyscraper; that over 70 miles of wire and 30 miles of conduit are incorporated into the electrical system; and the hi-fi system broadcasts sound through 600 speakers.

ESTIMATING FORUM–X

Operating Costs— Low Overhead Markup on Large Contracts

By Ray Ashley, *Research and Consulting Engineer, Oak Park, Ill.*

QUESTION:

How can contractors take exceptionally large contracts, similar to war-time projects, with such low overhead markups?

ANSWER:

There are two main reasons: (1) volume of work involved; and (2) the method of operation.

DISCUSSION:

VOLUME. It is an established fact that overhead costs decrease as the size of the project increases. Research studies and contractor experience bear this out. Reasons for such variation have been discussed in previous articles comprising this series.

For contracts under $1,000, we may expect overhead to run from 25% to 45%. The curves in Fig. 1 show that Job Overhead for a $100,000 project would be 9.5%; that for a $1,000,000 project, 7.8%. And many of the war-time projects were for $1 million, or more.

METHOD OF OPERATION has a very definite bearing on overhead. Management and billing of large war-time contracts was quite different from the run-of-the-mill type of work. In fact, such projects hardly belonged in the same category as private business. They were, in effect, subsidiary to the main business and were handled as a separate operation. A project manager was selected and he, together with the entire construction crew, belonged to the job office. In fact, some projects had electrical contractor purchasing and accounting departments on the job site.

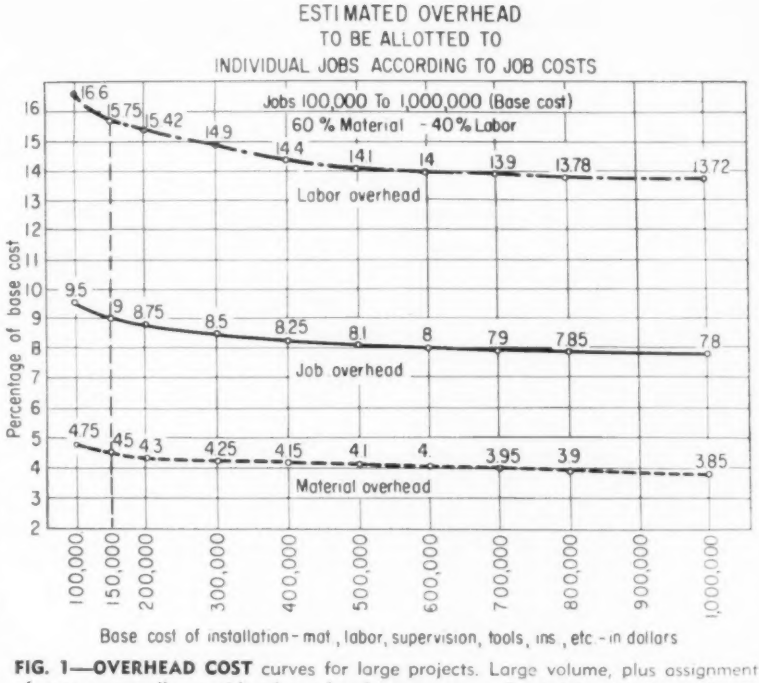

ESTIMATED OVERHEAD
TO BE ALLOTTED TO
INDIVIDUAL JOBS ACCORDING TO JOB COSTS
Jobs 100,000 To 1,000,000 (Base cost)
60 % Material - 40% Labor
Labor overhead
Job overhead
Material overhead
Percentage of base cost
16 15 14 13 12 11 10 9 8 7 6 5 4 3 2
16.6 15.75 15.42 14.9 14.4 14.1 14 13.9 13.78 13.72
9.5 9 8.75 8.5 8.25 8.1 8 7.9 7.85 7.8
4.75 4.5 4.3 4.25 4.15 4.1 4 3.95 3.9 3.85
100,000 150,000 200,000 300,000 400,000 500,000 600,000 700,000 800,000 900,000 1,000,000
Base cost of installation - mat., labor, supervision, tools, ins., etc. - in dollars

FIG. 1—OVERHEAD COST curves for large projects. Large volume, plus assignment of many normally considered overhead expenses as direct job cost items, brings general overhead costs down on large contracts.

Costs of all operations were charged directly to the job.

From the time the home office initiated the project and created the construction organization, it did little besides overall management. Some of the overhead costs normally experienced were shifted to the job and others were reduced. Job bookkeeping became a direct job expense and home office costs were limited.

For self-contained, isolated construction projects, it is difficult, under the best of conditions, to estimate the overhead markup for the home office. Such costs vary according to how self-sufficient the project organization can be. An organization that can function independently of outside support puts little burden on the home office. On the other hand, a field organization which depends upon the main office for engineering, bookkeeping and management support can prove costly.

The Job Overhead curve (Fig. 1) shows 7.8% for a $1 million project. This is for normal operation. Studies indicate that this figure could be reduced from 25% to 50% depending upon the project and the personnel available for the isolated job office.

As a hypothetical example, let's assume we have a $1 million project with 4% allowed for the home office expense (overhead only). This is $40,000. The work should be completed within a year, or perhaps a little longer. The contractor, then, would be getting $40,000, plus the profit on the job, for his management services.

460/265 volts for . . .

Load-Center Layout

BUS BAR FEED from transformer in utility vault was installed by Fisk Electric Company. Energy is supplied at 460/265-volts, three-phase, 4-wire from connections to utility company bus bars from transformers out of sight to left. Each phase of the supply is made up of three ¼-in. by 4-in. copper bus bars, and the neutral (at left) is made up of two ¼-in. by 4-in. bus bars. Each phase has a capacity of 50,000 rms amperes. As shown, the bus structure is braced by ebony-asbestos members on 2-foot spacings, with additional ebony-asbestos supports suspended by channel members from the ceiling to support the entire structure. The vertical channel supports are bolted to a channel member frame. In the bottom right of the photo, the bus bars pass through a double ebony-asbestos barrier which covers a wall opening from the utility vault to the adjoining meter room. The barrier plates overlap the opening by 4 inches on all sides.

Design and construction details of a modern, high capacity electrical system carefully matched to load requirements in the new Meyerland Plaza, a shopping center in Houston, Texas—electrically designed by James H. Howard & Associates, consulting engineers, and installed by Fisk Electric Company.

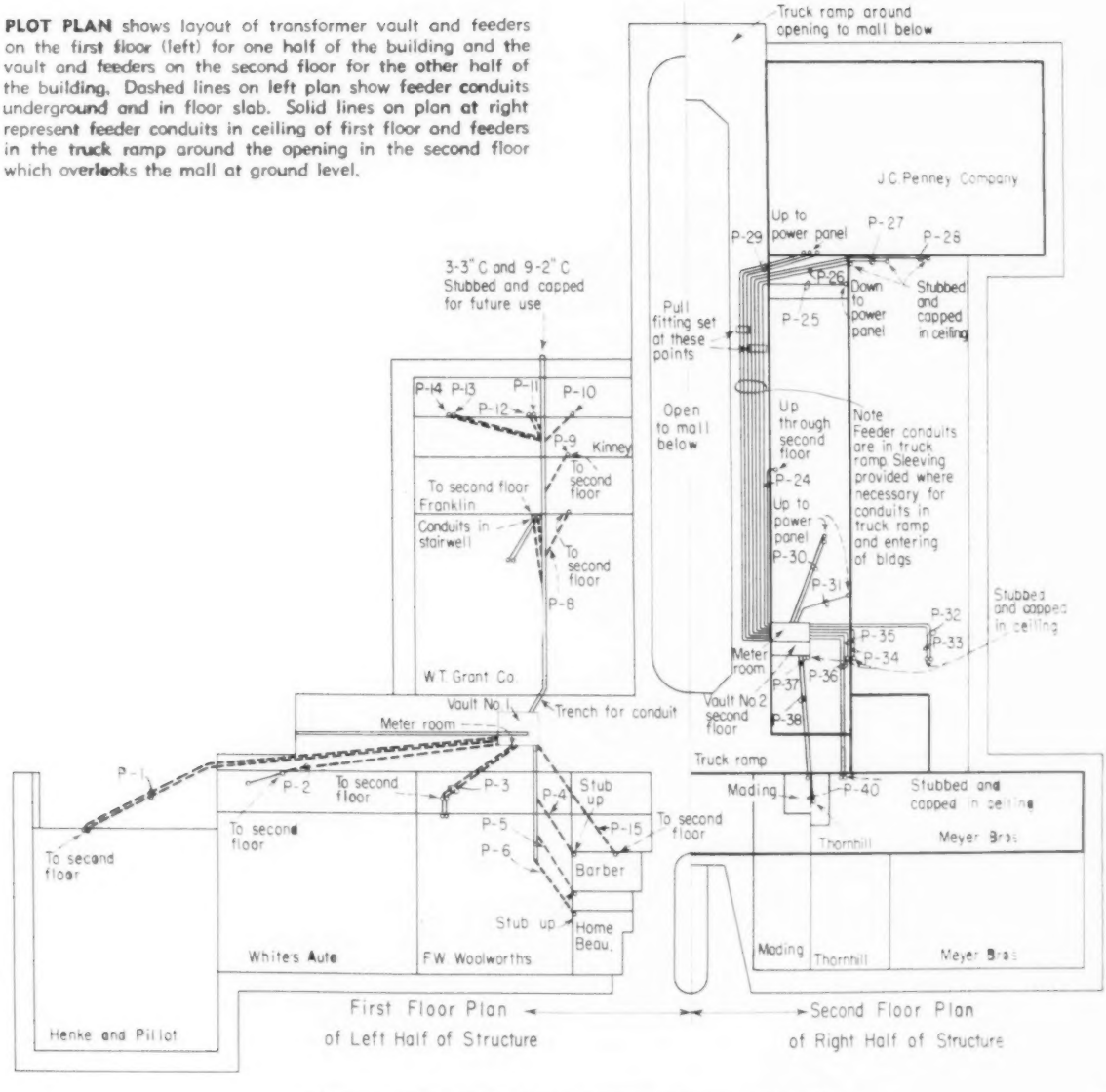
By John Ownby, *Engineer, Fisk Electric Company, Houston, Texas*

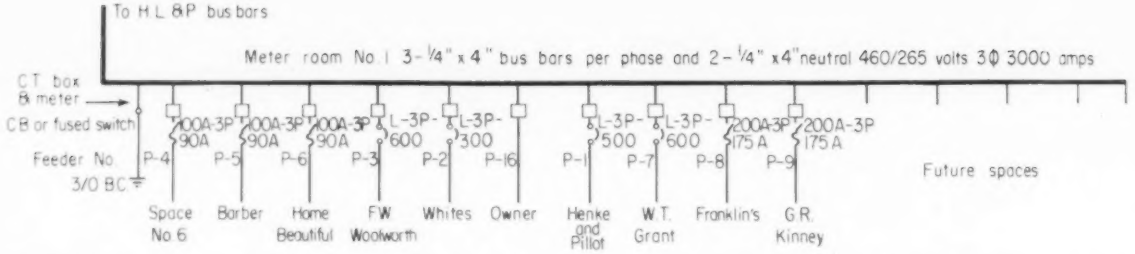
MODERN, 460/265-volt, 3-phase, 4-wire distribution is the firm backbone of a high-capacity economical electrical system at Meyerland Plaza shopping center, Houston, Tex. Here, two primary supplies to inside transformer vaults divide the total load of the shopping center. Circuiting of the various loads is handled from local load centers at two voltage levels—460/265 and 120/208. Analysis of this system reveals some interesting design details and a variety of unusual construction work.

Each of the two transformer vaults which supply the shopping center handles one-half of the two-story structure. This is shown in the plan diagram of the building. For one-half of the building, an underground utility line is brought into a transformer vault constructed in a driveway at the ground floor level of the building. A second primary supply to the premises is brought underground to the approximate load center of the other half of the building and then carried up to the second transformer vault on the second floor. The locations for the transformer vaults were selected to provide approximate load center installations in space available for such facilities. The first floor vault does not take up rentable space. The other vault was placed on the second floor because the space was available there, and the feeders for that half of the structure were carried to large second floor load centers in

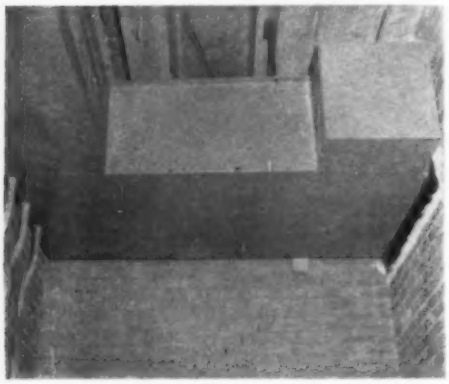
In A Shopping Center

PLOT PLAN shows layout of transformer vault and feeders on the first floor (left) for one half of the building and the vault and feeders on the second floor for the other half of the building. Dashed lines on left plan show feeder conduits underground and in floor slab. Solid lines on plan at right represent feeder conduits in ceiling of first floor and feeders in the truck ramp around the opening in the second floor which overlooks the mall at ground level.

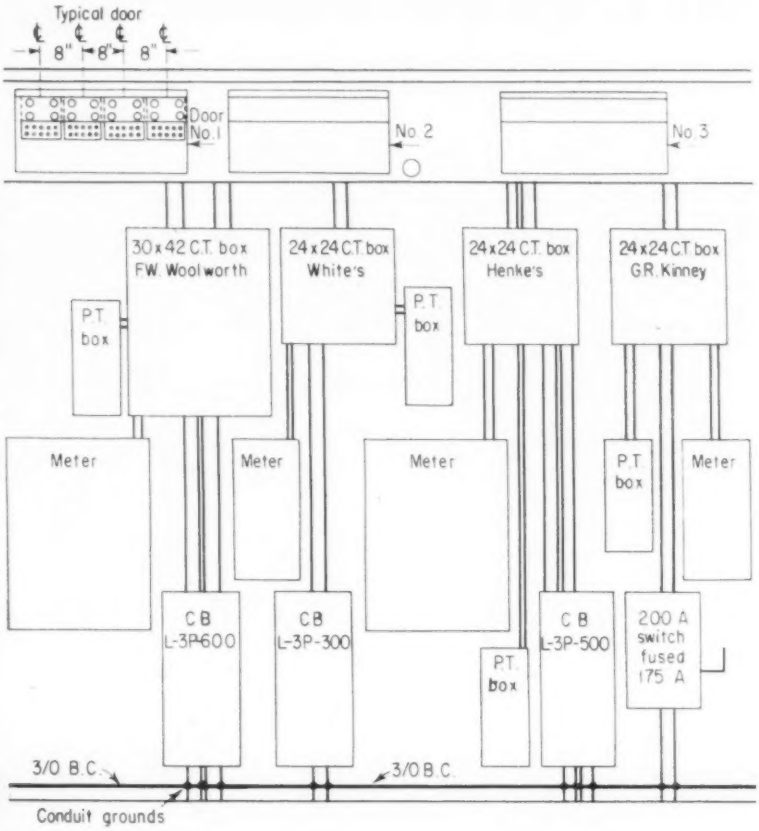




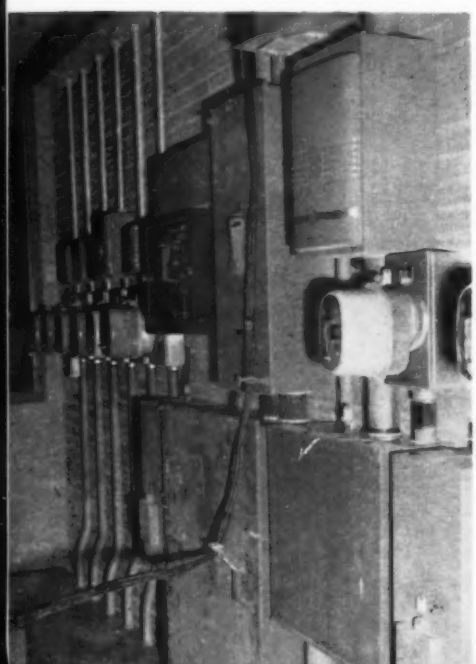
METER ROOM adjoining first floor transformer vault is fed by an enclosed busway structure around part of the ceiling perimeter of the narrow room. This busway contains three ¼-in. by 4-in. bars per phase and two ¼-in. by 4-in. neutral bars, and has a capacity of 3000 amps per phase. Feeders originating in this distribution center are indicated here. As shown, the owner's power panel is fed from the busway and is installed in the meter room. The frame size and rating of CB's is shown. Feeder protection on circuits of less than 200 amps is economically provided by fused disconnect switches with current-limiting fuses. Feeders are numbered to correspond to plot plan numbers.



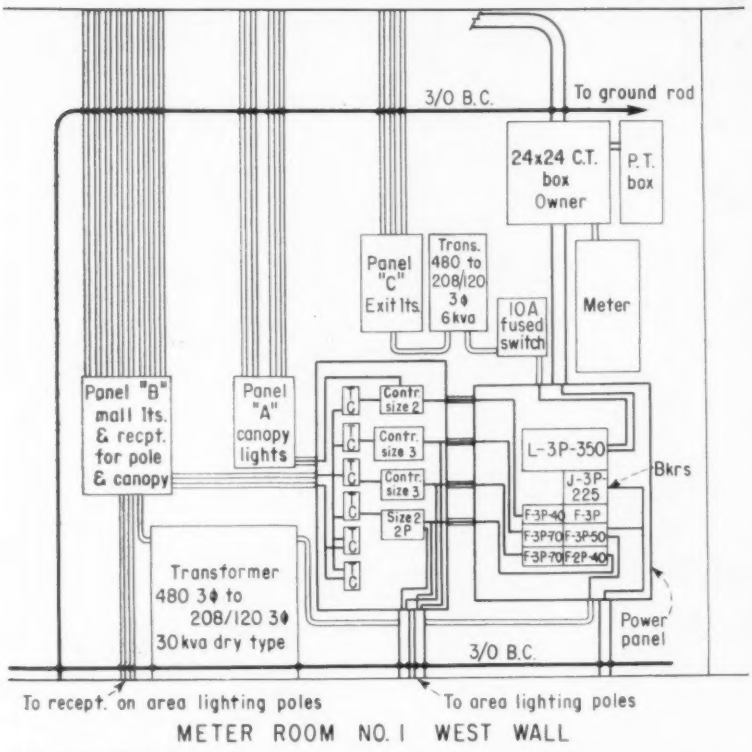
BUSWAY STRUCTURE in meter room is a sheet steel enclosure with ventilation grilles (top of photo, left of center) housing bus bars connected to transformer vault busway through ebony barrier shown on wall at right. Assembly is suspended from ceiling slab by rod hangers. Busway makes almost complete loop around the ceiling perimeter of the long, narrow meter room. Typical conduit taps to bus are shown at left. All feeders tap down in conduit from the busway into the metering, disconnect and protective equipment.



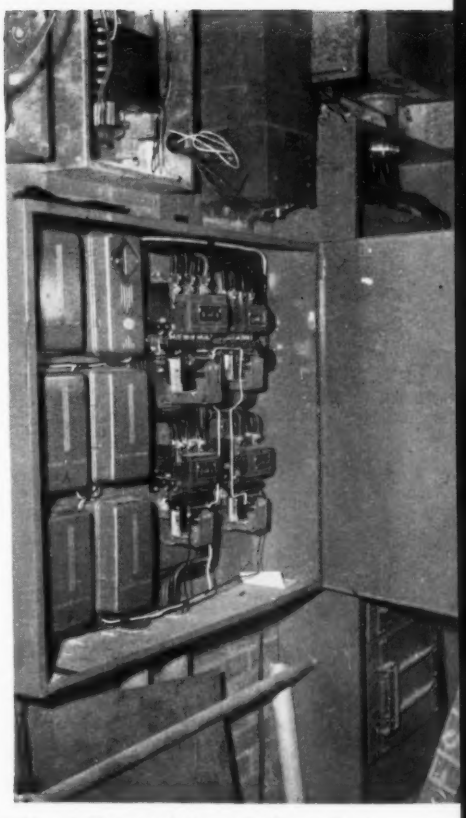
WALL SECTION in meter room shows arrangement of metering and disconnect equipment in relation to busway above. Doors in side of busway provide access to lug plates for connection of feeders to bus bars. No. 3/0 bare copper ground conductor is shown at bottom. This grounds all conduit steel to a driven ground rod arrangement and to a water pipe.



EQUIPMENT LAYOUT on wall of meter room consists of surface mounted enclosures for meters, current transformers, potential transformers, circuit breakers for protection and disconnect of circuits rated over 200 amps and fused switches for circuits rated 200 amp or less. Conduits come down from busway structure above. Feeders go out to load centers in the floor slab and in trenches under the floor, as shown in plot plan.



METER ROOM NO. 1 WEST WALL

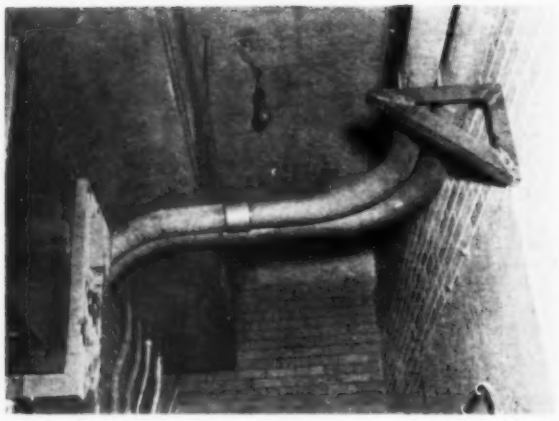


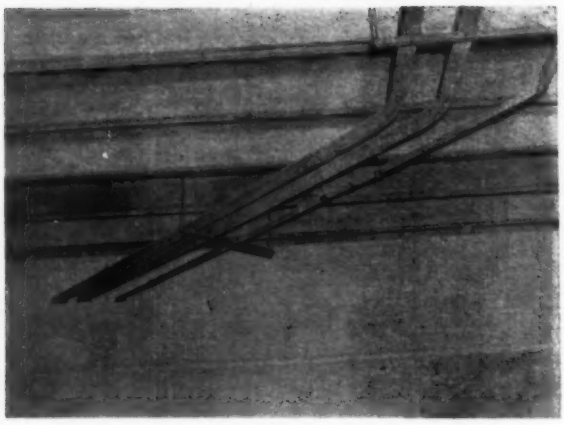
OWNER'S SERVICE and distribution equipment are mounted on one wall of meter room No. 1. The supply is made from above by three 500 MCM and one 4/0 conductors in 3½-in. conduit, tapped from the overhead busway on the opposite wall. Outgoing circuits are run in the ceiling and floor slabs. Sizes and ratings of CB's are indicated on the power panel. For canopy lights, 265-volt circuits are used, fed from a panel controlled by a contactor and time switch. Mall lights, exit lights and outside receptacle circuits are supplied through 480—120/208-volt, dry-type, step-down transformers. Photo at right shows time switches and magnetic contactors in panel. These time controlled circuits operate the outside lighting. The 6-kva transformer for exit lights is shown in the top center of photo. The time switch clocks are energized from Panel "B" by a 120-volt circuit. The time switch contacts operate the coil circuits of the 460-volt magnetic contactors. Two of them operate contactors in split bus panelboards, controlling all of the circuits fed from the bus on the load side of the contactors.

stores spread over a long, straight distance.

Vault No. 1 on the first floor feeds an enclosed bus structure in an adjoining meter and distribution room. Here, the bus assembly is mounted along part of the ceiling perimeter of the very narrow room. This bus is energized at 460/265 volts, 3-phase, grounded, on four bus conductors. Feeders to various store load centers on both the first and second floor of the half of the building are tapped from this busway. These feeders are carried out of the meter room in conduit in the first floor slab and underground, then up to load center panels on the first floor for some stores and on the second floor for other stores. Some of these are single-conductor-per-phase feeders in conduit; the high capacity circuits are multiple-conductor feed-

SECOND FLOOR meter room is supplied from transformer vault No. 2, behind wall at left. Equipment layout is similar to that in meter room No. 1. Enclosed busway around top of room is tapped to disconnect and metering equipment. Two large conduits at left are feeders for two large capacity tenant load centers. These feeders are carried up to the ceiling, across to other side of small, narrow room, down through the floor slab and then horizontally under the second floor slab to the load centers.

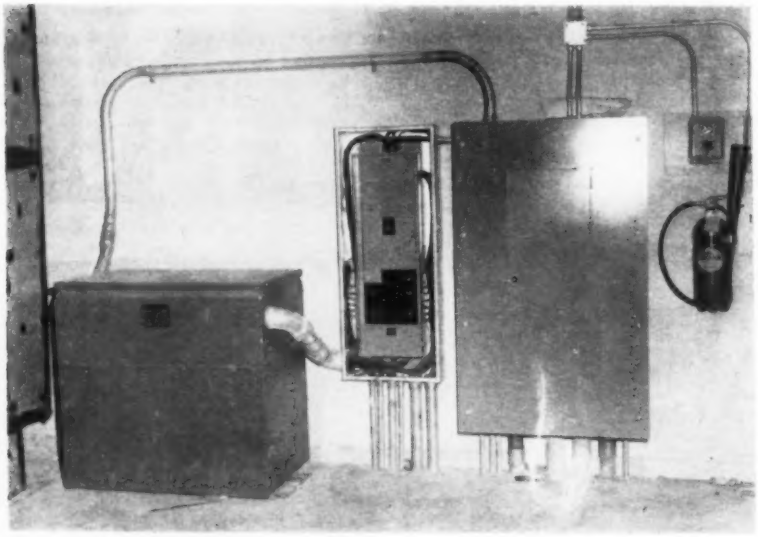




FEEDER DETAILS show (left) closeup of angle iron support bracket for two 3-inch conduit feeders running across the meter room from right to left, then down and out to loads. Bracket is of welded construction and is bolted to the wall. The conduits are held in place by U bolts on the bracket. At right, the two large conduits and a smaller one are run across the ceiling of the first floor walkway, as shown in the plot plan. A channel frame trapeze supports the conduits in their run. The supply is coming from the openings in the wall (back, left) and is running to the loads out of the photo at top right. Lateral runs from second floor vault are carried in ceiling space of first floor, then up through second floor to load centers.

ers in multiple conduits. The owner's distribution center is located in this meter room and supplies circuits for exit lights, canopy lights, parking area lights and outside receptacles around the perimeter canopy.

The second floor vault supplies a layout similar to that described above. In this case, the feeders to the two floors of the right half of the building are run to load centers in the second floor slab and in the truck ramp which runs around the second floor slab opening to the long wall on the first floor level. At the individual load center points, the wire-and-conduit feeders turn up or down to tie into load centers.

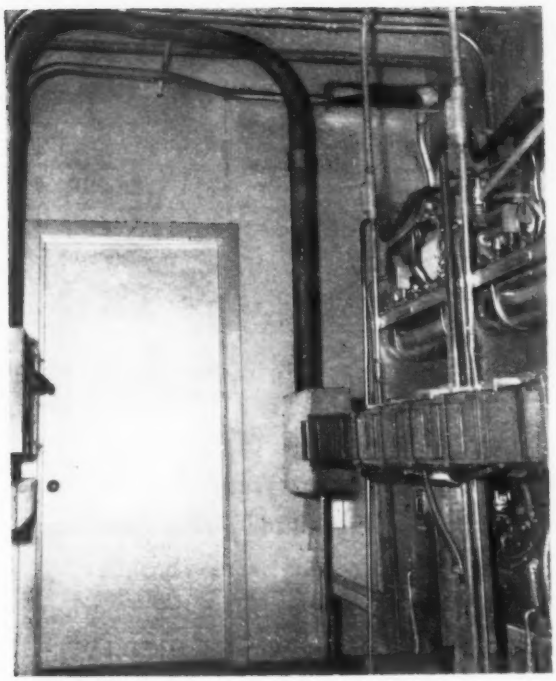


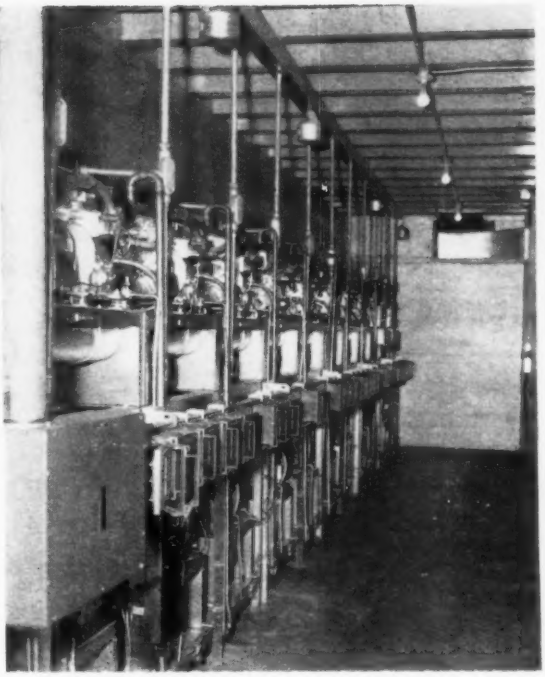
TYPICAL LOAD CENTERS throughout the shopping center are represented by the one shown here. The large center is installed in a mechanical room on the second floor and serves the large Woolworth store. A multiple feeder of eight 250 MCM conductors in two 3-in. conduits comes up into the bottom of the large, 600-amp, 460/265-volt power panel at right. Subfeeders from this panel supply 265-volt lighting panels, individual fan motors (up to 1½ hp), a motor control center out of sight to the right and the 75-kva, 460 to 120/208-volt transformer at left. The transformer feeds the center panelboard which provides disconnect and protection for subfeeders to 120-volt panels for lighting and receptacle circuits. The motor control center incorporates CB's for motor branch circuit short-circuit protection and starters for various motors—two 7½-hp, ½-hp, 15-hp and 100-hp—for air conditioning of the store. The operating coil circuits of the starters are supplied from a separate single-phase, 460 to 220-volt control transformer. This transformer is fed from a 2-pole, 15-amp CB in the motor control center. The CB provides protection for the transformer and for the control circuits in the starters. Some other load centers are more extensive; some are much simpler.

At the various store load centers, the layouts of equipment generally include a power panel and a motor control center. Of course, the size and complexity of each local load center depends upon the size of the store. Accompanying photos and diagrams show typical store layouts. At each load center, motor circuits and some lighting circuits are derived from the panel at 460/265 volts, and a dry-type stepdown transformer is used to supply 120/208-volt circuits for other lighting and receptacle loads.

Throughout the wiring system in this shopping center, the emphasis is on convenience and efficiency through the use of modern circuit techniques. The use of 265-volt lighting is one example of this. Another is the widespread use of automatic, time-clock control of lighting circuits. The use of split-bus panelboards with magnetic contactors operating large blocks of circuits is common in this installation. Analysis and details of applications are shown in illustrations.

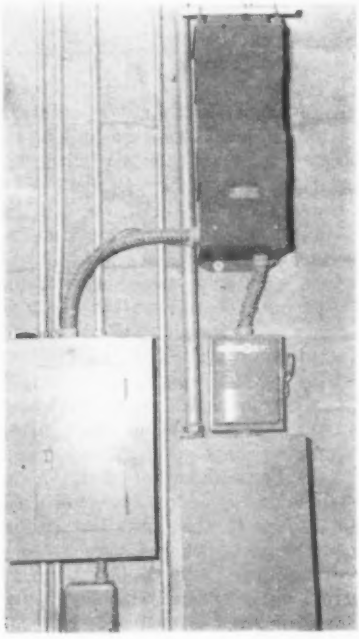
Architects of the Meyerland Plaza shopping center were Thompson McCleary and Werlin and Kiefner, Associated Architects, Houston, Texas.



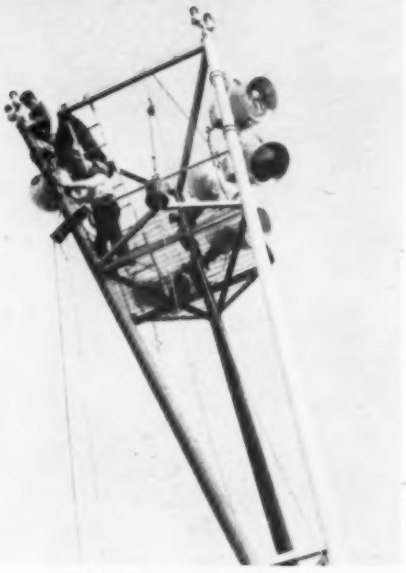


COMPRESSOR ROOM on the second floor of the food supermarket houses individual refrigeration compressors for display cases downstairs in the store. In photo at left, a 3-in. conduit carrying four 250 MCM conductors originates from a 3-pole, 200-amp CB on the wall at left. The CB taps the wireway shown which is fed from a 112-kva, 460 to 120/208-volt transformer. The 3-in. conduit runs up, over to the right then down into a size 5 magnetic contactor which is mounted on the end of a 225-amp busway run about 30 in. above the floor. The contactor feeds the bars in the busway and is controlled by a time switch in its coil circuit. The photo at right shows the compressor room, looking from the contactor down the line of busway. The unit compressors are racked two high for the length of the room. Along the busway, individual fused bus tap switches provide short-circuit protection and disconnect means for the individual motor branch circuits to the compressors. With this hookup, the busway is a motor subfeeder. Magnetic motor controllers with running overcurrent protection are mounted on the compressor rack. The coil circuits of these starters are carried in flex from the starters to the vertical lengths of $\frac{3}{4}$-in. conduit, then up to the wireway shown running along the ceiling. The control circuits are run to the locations of their temperature sensing devices in the cases downstairs. The contactor on the 225-amp busway provides automatic, timed shutdown of the compressors during off hours.

JOHN OWNBY, author of this story and project engineer for Fisk Electric Co., electrical contractors, is shown here in his field office on the job site at Meyerland Plaza.



EQUIPMENT GROUND continuity is assured in this installation where a solid, bare copper grounding conductor is used to jump the two flex connections between the transformer and the disconnect switch and the panel. The 460- to 120/208-volt transformer is supplied through the fused safety switch which taps a feeder in the box. The secondary supplies a 120/208-volt lighting and appliance panelboard at left. The effectively grounded transformer frame provides a suitable connection point for the secondary neutral which must be grounded to meet code requirements on system grounding.



ATOP 75-FT-HIGH PYLON, workmen install newly designed floodlights to illuminate nearly 160 acres of parking area at New York International Airport. Floodlights, weighing 59 lbs and measuring 22 inches in diameter, are lamped with 1500-watt mercury tubes having 81,000-lumen initial output. Depending upon location of towers and level of illumination required for adjacent areas, number of luminaires vary from 12 to 4 per pylon.

Ground-up analysis resulted in . . .

New Lamp

Reversing normal design procedure, objectives for this mammoth lighting plan were initially established as starting points; then desired results were obtained by determining the "unknown quantities". This engineering approach led to the development of a new 1500-watt mercury-vapor lamp, a new luminaire and a unique 75-ft-high tripod pylon.

FLOODLIGHTING for parking and roadway illumination at International airport is impressive in both scope and lighting results, for nearly 160 acres of parking space are lighted by specially-designed mercury quartz vapor lamps, while custom-designed luminaires provide virtually-glareless lighting coverage.

Conceived by T. M. Sullivan, N. Y. Port Authority's aviation planning chief; designed by Abe H. Feder, lighting consultant; developed by the outdoor lighting and large lamp departments of the General Electric Company; and installed by the Broadway Maintenance Company—these new floodlights provide almost three times more light output than standard 1500-watt incandescent floodlights. This, in turn, permits unusually high mounting positions and justifies the adoption of a plan requiring only a third as many floodlights and only 16% as many standards as would have been used to illuminate this sizable area by conventional means.

These new floodlights, designated as L-101s and incorporating many of the best features of general purpose L-69s, are mounted in clusters of 6, 8, 10 and 12 units atop specially-designed 75-ft-high 3-legged steel pylons which are spaced approximately 320 ft apart. Lamps are 1500-watt units rated at 81,000 lumens, and, when housed in luminaires which were developed for this specific application, illumination levels in the order of 3 to 8 footcandles are obtained at ground level, over the entire area served.

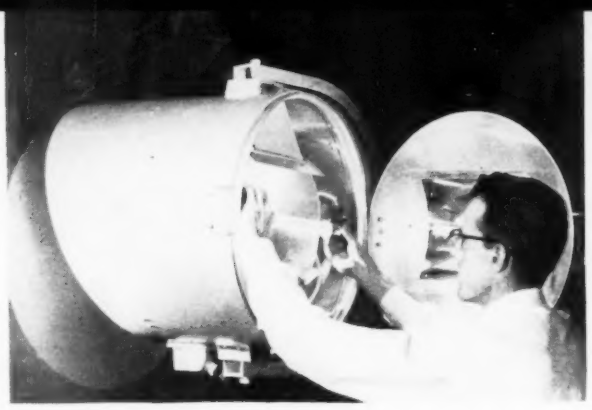
Luminaires measure approximately 22 ins. in diameter; have 20-in. shatter-proof weather-resistant clear-glass covers, and weigh 59 lbs each. In all, there are 338 of these units mounted on 43 pylons. Flexibility of the system is such that luminaires may be targeted to provide either uniform coverage or to highlight specific areas, as desired.

Of additional interest is the fact that the system was designed to create "aesthetic nighttime beauty from *above*"—a fact which was deemed important since the lighting pattern is being observed from the air by approximately 150,000 airborne passengers (arriving at or departing from the airport on 3300 flights) each month. This emphasis upon symmetry and beauty from above is probably the first large-scale example where aerial appearance has played a major role in design considerations for a lighting system.

Design Based on Objectives

Design procedures were based on objectives which were established as starting points, while components necessary to obtain these results became "unknown quantities" to be determined.

Since it was reasoned that higher - than - normal mounting heights for luminaires would minimize glare, permit easy targeting of all areas, increase the permissible distance between towers and thereby reduce the number of towers required, the first decision was to "go up in the air". Height, however, had to be limited by practical safety considerations (obstructions to aircraft; glare for control tower personnel, etc.), maintenance problems, floodlight beam patterns and wattage of lamps. Balancing all these considerations resulted in the selec-



NEW MERCURY VAPOR lamp is 1500-watt tubular and jacketless unit producing 81,000 lumens when operating at 3.9 amps and 425 volts. Horizontal mounting in this prototype luminaire produced desired beam spread and pattern. As noted, luminaire has hinged back for relamping purposes, while yoke mounting permits pivoting of unit through 180 vertical and 360 horizontal degrees.

and Luminaire Design

. . . to floodlight 7-million plaza at International Airport

tion of a tentative mounting height between 70 and 75 ft.

With this probable mounting height and an estimated spacing interval of 300 ft established, the problem of overlapping lighting patterns was considered. This involved the determination of desired beam characteristics, distance of throw, number of luminaires and placement of those luminaires atop the towers. The subject of placement, in turn, suggested the creation of a triangular mounting pattern for floodlights, since this arrangement of lights, in two tiers, would permit focussing in any desired direction without creating structural projections to mar clean architectural lines or to interfere with light beams. This thinking directly influenced the final design of the towers, which are three legged (legs crossing each other approximately at their mid-points, suggesting apex-to-apex tripods) and which are surmounted by hexagonal-shaped mounting platform set 8 ft below tops of arms.

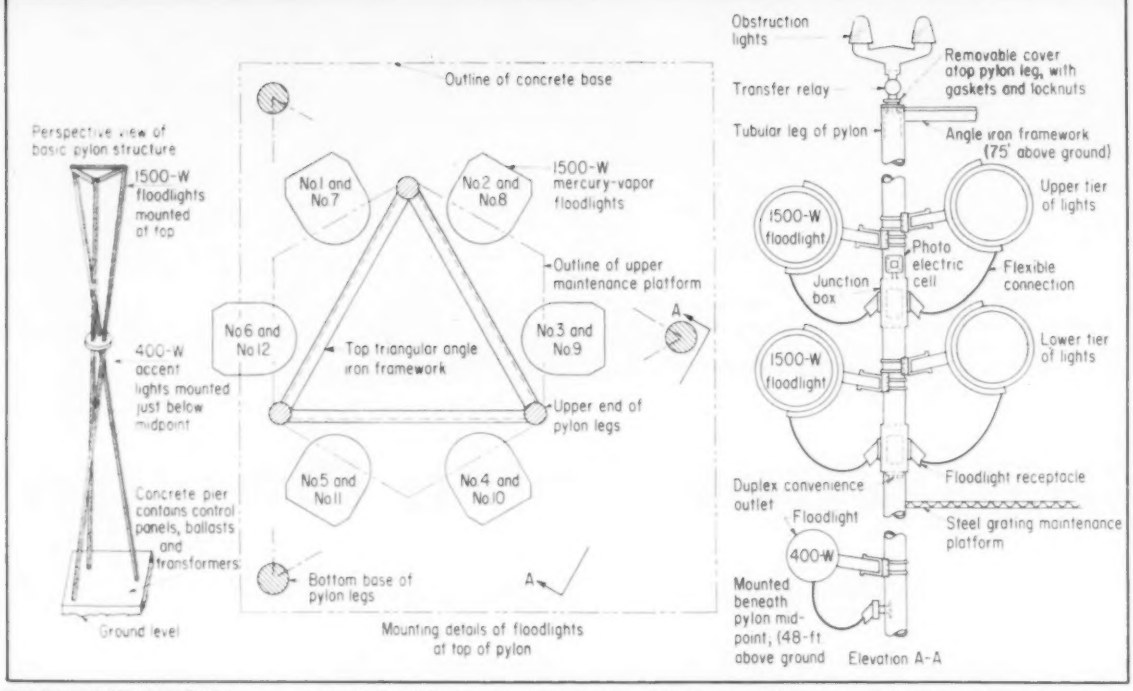
Next to be considered was a suitable light source and, in order to obtain a compact high-output lamp, thinking was directed toward mercury vapor. Also considered was the fact that a linear light source, mounted horizontally in a properly-designed reflector, would produce a desired rectangular beam spread more easily than an incandescent point source. Considerations therefore included the existing 3-kw single-contact spade-terminal A-9 lamp. But, although the initial output (132,000 lumens) and rated life (6000 hours) of this lamp strongly recommended its use, its size (55 ins.) suggested that a luminaire to house it would be too bulky and unsightly for this installation.

THIS NIGHT VIEW clearly indicates how wide parking area is evenly illuminated by blanket of floodlighting which averages 5 footcandles in intensity. Total area so illuminated approximates 160 acres. Design of new mercury lamp, luminaire and tower resulted from engineering approach of starting with desired results, then working backwards to determine what equipment would be required.

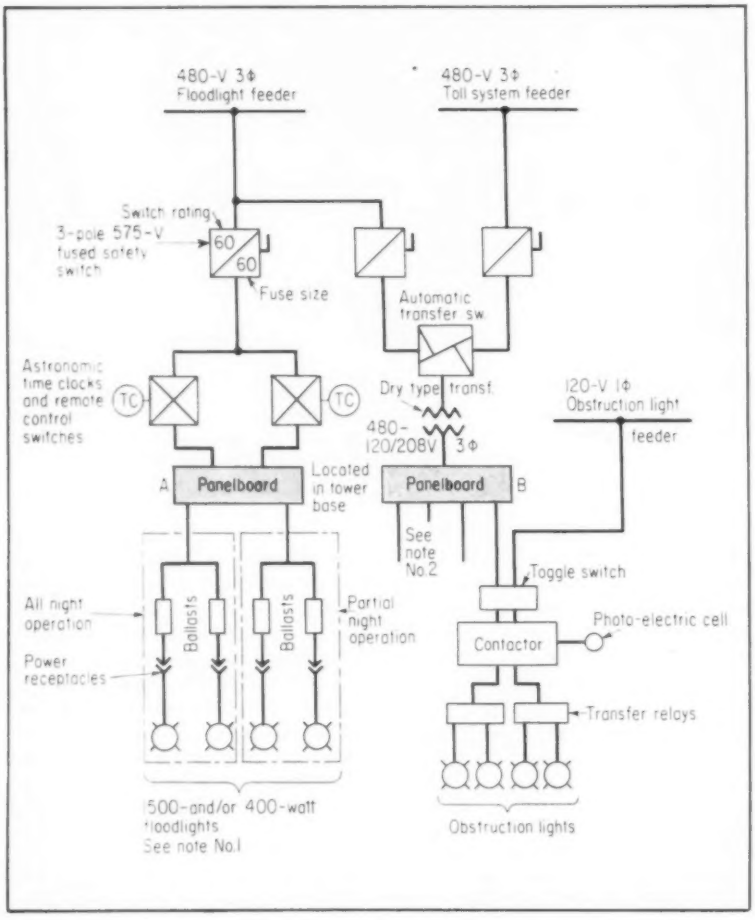
Development of New M-V Lamp

An entirely new lamp was therefore specified and produced (by G. E.); being designed on the principles of the A-9 but restricting the overall length to 20 ins. and the actual light center to an even foot. Contained in a quartz tube, this new lamp is a 1500-watt tubular and jacketless unit; producing 81,000 lumens, operating at 3.9 amps and 425 volts, and rated for 6000 hours at 5 hours per start.

While the lamp was being designed and produced, specifications were drawn up calling for a new luminaire with adjustable yoke mounting, weatherproof protection, Alzak aluminum reflectors and a design efficiency of at least 55%. Also specified was the satisfactory functioning of the unit at a height of 70 ft, plus resistance to with-



THREE-LEGGED PYLONS have overall height of 75 ft, with hexagonal maintenance platforms set 8 ft below triangular top, and with 10½-ft-sq concrete bases also serving to house transformers and switchgear. Wiring between vaults and luminaires is via rigid conduit. In general, six upper mounting positions were used first, in order to obtain maximum height, minimize glare and permit easier maintenance from platform. Floodlight luminaires are designed to withstand 125-mph wind force, the action of vibration and salt spray, and the deleterious effects of ultra-violet radiation.



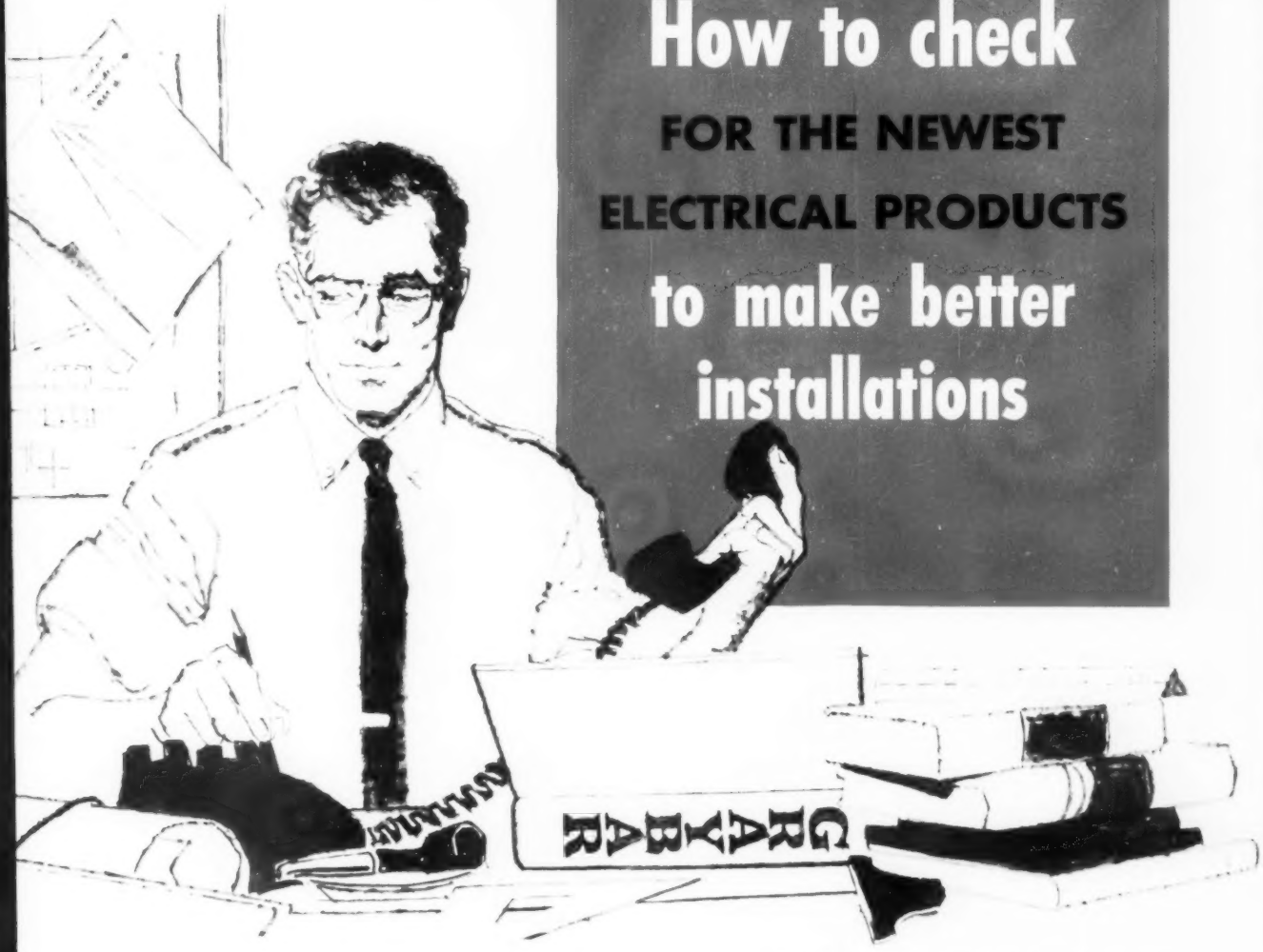
stand a 125-mph wind force, the action of vibration and salt spray, and the effects of harmful ultra-violet radiation. Finally, specifications for reflectors dictated desired widths and heights of beam patterns at varying distances from the base of the towers.

As finally designed, the luminaire can be pivoted through 180 vertical and 360 horizontal degrees; has a hinged back for relamping purposes; has a remotely-located ballast with a 95% power factor designed to permit starting at a minimum temperature of minus 10 degrees F, and has weight and dimensional specifications as

(*Continued on page* 291)

VAULTS, located beneath triangular pylons and serving as supporting foundations for same, contain ballasts for mercury floodlight units mounted above, all related switchgear and timing mechanisms, plus dry-type transformers that step 480-volt power down to 120/208-volt level. In those cases where 400-watt mercury floodlights are mounted on towers, (in addition to the 1500-watt units), two such 400-watt lights are connected to each ballast (Note No. 1). Panel A in this sketch controls all 480-v floodlights, while Panel B controls such 120/208-volt items as obstruction lights, photo cells, toll booths, canopy lights, ticket dispensers, signs, time clocks, vent fans and sump pumps (Note No. 2).

How to check
FOR THE NEWEST ELECTRICAL PRODUCTS
to make better installations



Leading electrical manufacturers are constantly bringing out new or improved products to help you do a better job, or to cut time and cost on construction and maintenance work. And here is how you can keep a continuous check on over 200 leading manufacturers for the newest and most up-to-date equipment and supplies for your own requirements. *Always CALL GRAYBAR FIRST — for every electrical need!*

At Graybar, we'll welcome your inquiry, large or small, from a roll of tape to a mile of cable. We are in daily touch with the country's top manufacturers who are our suppliers. Information on the newest products is yours for the asking. Just pick up your phone, call your nearest Graybar office. Put the people in our more than 130 offices and warehouses to work for *you*.

Plant men note: Some industrials have their own electrical staff, others do not. The qualified electrical contractor, today is a team-worker of the highest order. And his services, together with Graybar's are instantly available for help in solving electrical problems.

To find your nearest Graybar location, check the list of offices on the back page of this section.

GRAYBAR ELECTRIC COMPANY, INC.
420 Lexington Avenue, New York 17, N. Y.
IN OVER 130 PRINCIPAL CITIES

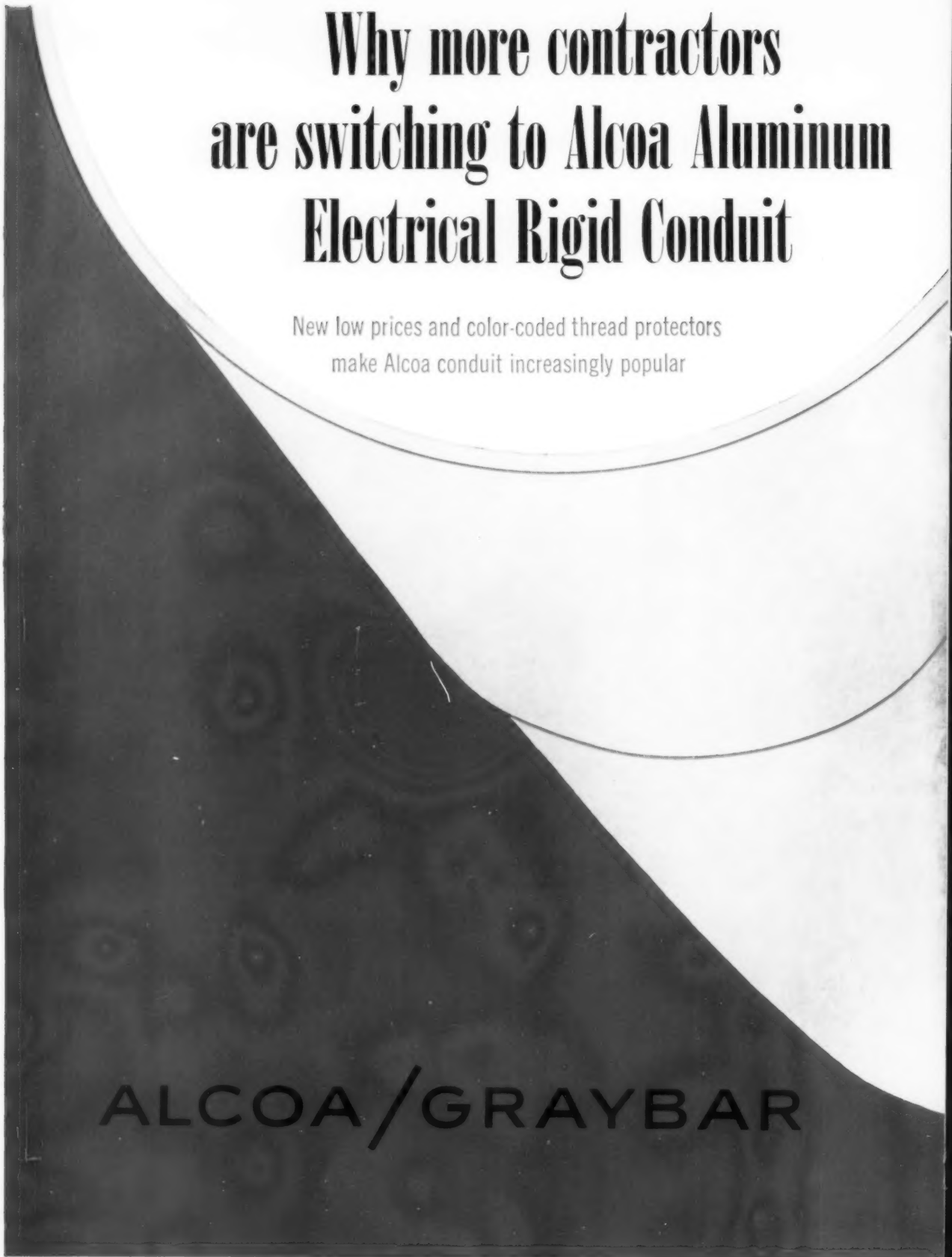
To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

Why more contractors are switching to Alcoa Aluminum Electrical Rigid Conduit

New low prices and color-coded thread protectors make Alcoa conduit increasingly popular



To spot what's NEW and best for you

call GraybaR first for...

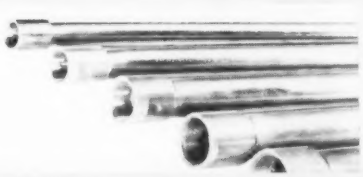
'GraybaR Everything Electrical 'GraybaR

Because everyone is cost-conscious today, a growing number of contractors and engineers are recommending Alcoa® Aluminum Electrical Rigid Conduit. For electrical distribution systems in office buildings, industrial plants, refineries, breweries and other new and remodeled structures, Alcoa Aluminum Conduit is an economically sound investment. Here are some of the exclusive advantages:

- Light weight—one-third that of other metallic conduit. Lower costs for installation, freight and handling.
- Lower prices in all sizes. Aluminum is competitive with other materials.
- Corrosion resistance—longer life, lower maintenance costs and freedom from staining and painting.
- Color-coded thread protectors in all sizes up to 6″. Conduit size identified at a glance.
- Easier cutting, bending and threading.
- Factory-applied internal lubrication to facilitate wire pulling.
- Clean appearance important to modern architecture.
- Approved by Underwriters' Laboratories, Inc.

Find out why Alcoa Aluminum is *your* best conduit buy. Call your nearest Graybar office. You can get fast delivery right from stock.

your best conduit buy is Alcoa Aluminum



ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

GraybaR QUALITY SINCE 1869 *REG. U.S. PAT. OFF.
Distributed by GraybaR ELECTRIC COMPANY

Your Guide to the Best in Aluminum Value

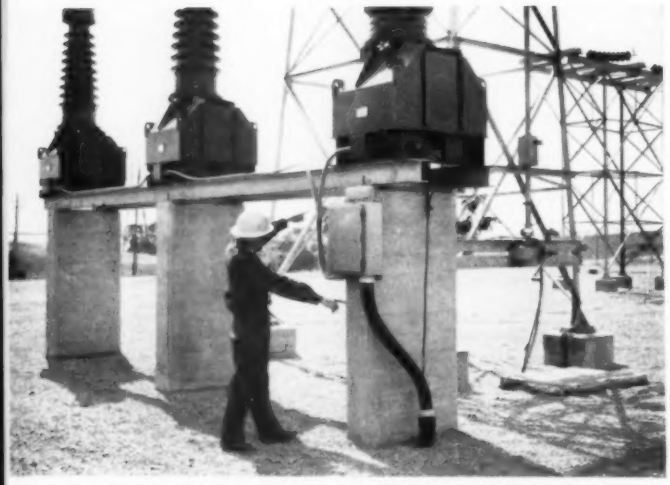
"ALCOA THEATRE" Exciting Adventure Alternate Monday Evenings

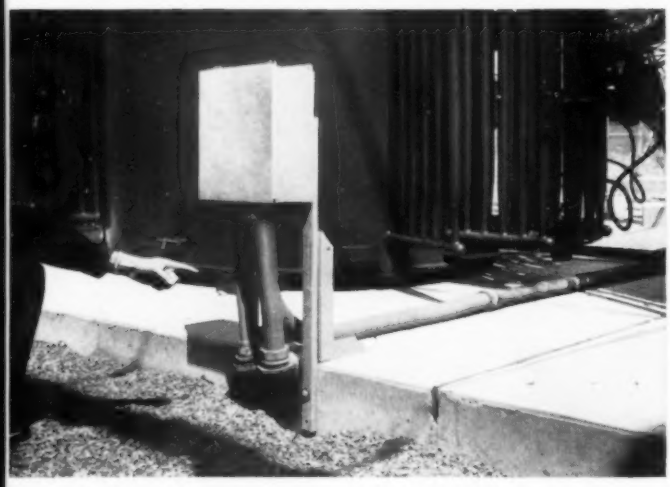
your guide to fast, dependable service

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR





1 Sealtite—installed at Perry, New York, substation, New York State Electric & Gas Corp., on supervisory carrier current control equipment. **2** Sealtite is also used between 115,000 volt potential transformers and cabinet, and between cabinet and underground conduits. It speeded installation materially. **3** Connecting automatic forced air cooling to 15,000 Kva transformer bank, Sealtite absorbs movement set up by vibration of the equipment. No cracked or damaged conduit here!

"Sealtite solves a lot of problems at substations"

reports Mr. Leon Wheaton, construction and maintenance foreman, New York State Electric & Gas Corporation

"It's twice as fast to install as rigid conduit—and it really stands up under heat, wind, rain, snow and ice."

Sealtite* flexible, liquid-tight conduit resists the weather and corrosive conditions that often knock out ordinary metal conduit. Wiring can't be damaged. Protection is complete. That's one reason more and more utilities across the country are using this unique conduit in plants and substations.

Also—flexible Sealtite saves the time and expense of planning, cutting, cornering and fitting rigid conduit. Installations are faster. Sealtite takes up movement, vibration . . . makes a neat appearance . . . facilitates the replacement of motors and other equipment.

WHERE TO GET SEALTITE—Electrical Wholesalers stock Types U.A. and E.F.† Sealtite in easy-to-handle coils, in black or gray. Be certain you ask for and get the quality conduit marked "Sealtite" on the cover. Buy it in long lengths on reels or in cartons and cut it on the job without waste. Your wholesaler also stocks liquid-tight connectors. Free Booklet S-538 gives full information on Sealtite. Write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. Sealtite is approved by Canadian Standards Association.

*Trademark †Pat. Applied For 57182GR

CUTAWAY SECTION of Type U.A. Sealtite shows tough polyvinyl jacket over flexible metal core. Copper conductor wound spirally inside conduit gives positive ground.

Insist on the conduit marked

SEALTITE

flexible, liquid-tight conduit

an ANACONDA® product

To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

"AMERICAN BRAND" Utility Ropes IN NATURAL OR SYNTHETIC FIBERS

MANILA – Created especially for the utility field, "American Brand" and "AMCO All Weather" Pure Manila Ropes are used for hand lines, pole lines, guy ropes, hoisting and rigging. The special construction and exclusive lubricant reduces water absorption to a minimum and increases its resistance to weathering.

NYLON – About twice as strong as natural fiber rope, the initial cost is more because it will far outlast manila. Used for similar purposes as manila, its high strength permits the substitution of smaller and lighter ropes to accomplish the same job. Possessing high shock absorbency and high impact strength, nylon is unsurpassed as a safety line. In addition, it is easier to handle, impervious to rot, has greater flexibility and resists distortion and kinking.

Floterope – The new high tenacity polyethylene rope being used for hand lines, hot lines, pulling lines, sagging lines, guy lines and catenary lines. Floterope is 60% stronger than manila (the ¾" size has a breaking strength of 1050 lbs.), is an excellent insulator and exhibits low dielectric loss. On some installations, insulators, special fittings and extra brackets have been eliminated; fewer poles and wider spans have been possible; ice build-up and lightning damage have been reduced.

IN ALL SIZES ...¾" DIAMETER AND LARGER... IN COILS OR ON REELS

With this combination of "American Brand" Ropes, you can reduce installation and maintenance costs, eliminate safety hazards and improve operating efficiencies.

*GraybaR QUALITY SINCE 1869 *REG. U.S. PAT. OFF

Distributed by *GraybaR ELECTRIC COMPANY

Western Mill

ST. LOUIS CORDAGE MILLS
Eleventh & Lafayette Streets · St. Louis 4, Mo.

AMCO

AMERICAN
MANUFACTURING COMPANY, INC.
Noble & West Streets · Brooklyn 22, N. Y.

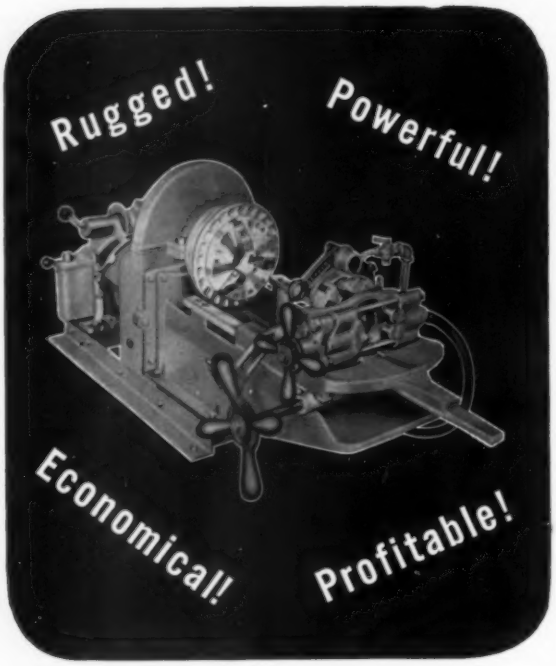
ROPE • TWINE • OAKUM • PACKING

Sales Offices: BOSTON CHICAGO HOUSTON NEW ORLEANS PHILADELPHIA SAN FRANCISCO

to spot what's NEW and best for you

call GraybaR first for...

GRAYBAR Everything Electrical GraybaR ELECTRIC COMPANY



New Beaver Model-A

The World's Fastest Portable Pipe Machine!

THREADS 2" PIPE IN 15 SECONDS!

A rugged, heavy-duty, portable, low-upkeep pipe and bolt machine. Range—1/8" to 2" pipe; 1/4" to 2" bolts; up to 12" with drive shaft. High production with low maintenance cost. Beaver Power Grip Wrenchless Chuck standard equipment. All gears run in oil. Has rack and pinion feed with 12" of working space. Cone reamer mounted on swinging arm. Increased oil flow delivers two gallons of oil per minute for perfect threads and longer die life. Oil pump easily accessible for quick, thorough cleaning. Mono-type, duo-type, and Quadra-type die heads available. Your choice of wheel or automatic knife cutoff. Built-in outboard pipe support instantly indexes for size. No double chucking. Motors—110/115 or 220/230 volts; 25/60 cycle Universal; 220/440 three phase, 60 cycle. Explosion-proof, or special motors and switches, extra.

Can't tell it all here! Send for New Beaver Quick Reference Catalog! Get the latest facts on ALL new Beaver machines!

The ALL NEW BEAVER Speed-O-Matic

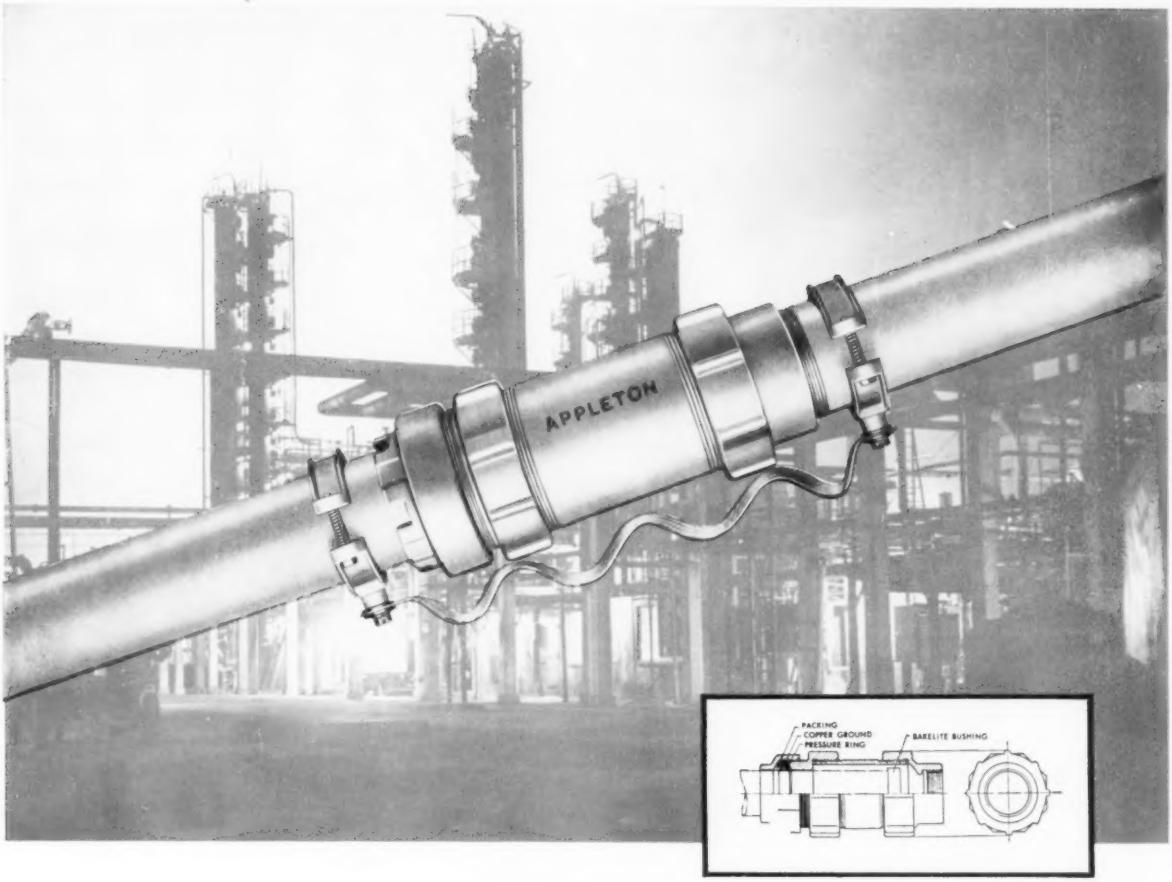
PORTABLE PIPE AND BOLT MACHINE

- 50% more speed and power from faster, all new motor! Motor and switch fully protected.
- New "CLEAR-VU," self-centering wheel and roller cut-off; die heads with high-speed steel dies; and reamer, all pivot mounted! Ideal for "make-up."
- Quick-acting Power Grip Wrenchless Chuck—forward or reverse!
- Threads 1/8" to 2" pipe (up to 12" with drive shaft) 1/4" to 2" bolts.
- Instant and accurate easy-setting spool-type pipe support eliminates double chucking.
- Lubricated for life!
- Oiling tube directs oil right to threading dies! Shuts off automatically.
- Lathe-type thread length indicator.

Can't tell it all here! Send for New Beaver Quick Reference Catalog! Get the latest facts on ALL new Beaver machines!

To spot what's NEW and best for you
call GraybaR first for...
GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

APPLETON® "XJ" Conduit Expansion Joints



Relieve the *strain* of expansion and contraction on long runs of rigid conduit

Temperature changes place a terrific strain on all long conduit runs. To relieve this potentially dangerous condition, it is best to install APPLETON "XJ" Expansion Joints at frequent intervals along the entire system. These weatherproof joints, for use with heavy-wall conduit, have a metallic packing and a bonding jumper to assure the entire conduit system remains a continuous electrical conductor. The jumper, installed in accordance with U. L. recommendations, gives double protection against extreme expansion movement reducing the effectiveness of the metallic bond.

As the conduit is inserted in the joint, a bushing is placed on the end in the manner shown. This bushing permits maximum conduit movement and yet the conduit can never pull free of the joint. The APPLETON "XJ" Conduit Expansion Joint features a metallic packing and pressure ring at the flexible end to keep the joint weatherproof at all times.

Wherever a long run conduit installation exists, the need for APPLETON "XJ" Expansion Joints exists. Interior or exterior, from Texas to Maine, temperature strains do exist, so take advantage of APPLETON'S product research program to give you the precision products you require . . . APPLETON "XJ" Weatherproof Expansion Joints for all long run conduit installations.

Sold Through Franchised Wholesalers Only

APPLETON ELECTRIC PRODUCTS®

APPLETON ELECTRIC COMPANY

1701 Wellington Ave., Chicago 13

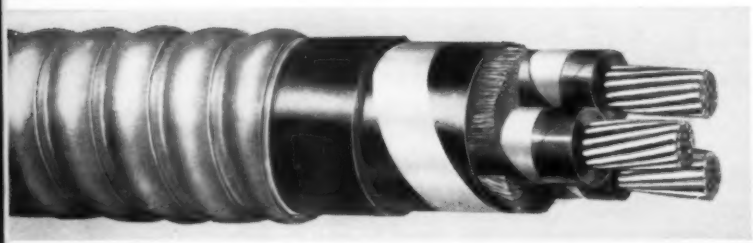
Also Manufacturers of:

To spot what's NEW and best for you

call GraybaR first for . . .

Everything Electrical GraybaR

Speed new power on old poles—cut costs
with Anaconda Duralox Interlocked-armor Cable



METAL TAPE ARMOR AFFORDS HIGH PROTECTION AGAINST DAMAGE—NO CONDUIT NEEDED.

When a large Gulf Coast refinery needed additional power, the job was done *quickly* and *economically* because Duralox* could be strung on existing power-line poles—below the old lines. Neither new poles nor cross-arms were needed.

Installation time and costs are slashed with Duralox. Outdoors or in, it is readily trained around or over machinery, beams, piping and other obstructions in long, unbroken runs.

Duralox increases plant flexibility, affords easy maintenance and minimizes down time because it is generally accessible, easily relocated—100% salvageable.

*Reg. U. S. Pat. Off. 571071GR

NEW BULLETIN DM 5606 contains full information about Anaconda Duralox Cable. Write for your free copy today. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

Ask the Man from

ANACONDA®
for DURALOX CABLE

EXISTING POLES are utilized at well-known refinery for additional power. Cable is Anaconda's 4/0 Awg Duralox Interlocked-armor Cable.

DURALOX CABLE is available in sizes No. 6 Awg to 750 Mcm—copper or aluminum conductors with rubber, plastic, or varnished-cloth insulation—up to 15kv. Underwriters' approved for 600 volts and 5000 volts, varnished-cloth insulation, galvanized steel armor!

To spot what's NEW and best for you

call GraybaR first for... Everything Electrical GraybaR ELECTRIC COMPANY

Bonus lighting ...yours with Catalina

Everyone gets a big Bonus with the exciting, new Catalina! A big *bonus in unitized polystyrene*, a special Benjamin lightweight construction that assures straight-line, quick, easy, economical installation! A *bonus in streamlined beauty* with extremely low silhouette. A *bonus in comfort lighting* with a balanced upward component for controlled brightness contrast. A *bonus in value* with a price much lower than you'd expect to pay for this quality fixture. Suspended or surface mounted . . . your bonus beauty is Catalina!

BENJAMIN

...always the source of good lighting

Now Setting the Pace in COMMERCIAL LIGHTING

R-358GB

FOR DESCRIPTIVE BULLETIN ON CATALINA, WRITE BENJAMIN ELECTRIC MFG. CO., DEPT. H, DES PLAINES, ILLINOIS

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

BENJAMIN ELECTRIC EXTENSION CORD REELS

Model 800JB-3

BENJAMIN ELECTRIC EXTENSION CORD REELS have many possible uses, as they can be supplied with two or three conductor electric cord and with or without a grounding wire and with various types of mounting arrangements.

The length of cord, that can be accomodated in the Cord Reel, depends on the number and gauge of the conductors and diameter of the electric wire. A number of Models of the BENJAMIN CORD REEL, which are available, are as follows:

Model 800-4

Series No.	Length & Type of Cord Set	No. & Gauge of Conductors	Trouble Light	Ground Wire	Female Connector	Ampere Rating	Size	Weight	Price Each
Model 995	20-SVO	18/2	TL			6	1⅞" x 7⅝"	5 lbs.	$ 9.95
Model 995JB	20-SVO	18/2	TL			6	"	"	10.95
Model 995-T	20-SVO	18/2	TL			6	"	"	10.45
Model 995JB-T	20-SVO	18/2	TL			6	"	"	11.45
Model 995-20-ML	20-SVO	18/2	TL			6	6½" x 10"	5¼ lbs.	16.50*
Model 700-20-SJ	20-SJO	18/2	TL			6	1⅞" x 7⅝"	7 lbs.	18.50
Model 700JB-20-SJ	20-SJO	18/2	TL			6	"	"	19.50
Model 700-20-SJT	20-SJO	18/2	TL			6	"	"	19.50
Model 700JB-20-SJT	20-SJO	18/2	TL			6	"	"	20.50
Model 700-25-SV	25-SVO	18/2			F	6	"	"	16.00**
Model 700JB-25-SV	25-SVO	18/2			F	6	"	"	17.00**
Model 700-20-ML	20-SVO	18/2	TL			6	7¾" x 10"	6¾ lbs.	19.00*
Model 800-1	50-SVO	18/2			F	6	2½" x 8¾"	10 lbs.	19.75
Model 800JB-1	50-SVO	18/2			F	6	"	"	20.75
Model 800-2	40-SJO	18/2	TL			6	"	"	21.75
Model 800JB-2	40-SJO	18/2	TL			6	"	"	22.75
Model 800-3	30-SJO	18/3	TL	G		6	"	"	24.75
Model 800JB-3	30-SJO	18/3	TL	G		6	"	"	25.75
Model 800-4	25-SJO	16/3		G	F	10	"	"	20.00**
Model 800JB-4	25-SJO	16/3		G	F	10	"	"	21.00**
Model 800-5	30-SJO	16/2			F	10	"	"	17.50
Model 800JB-5	30-SJO	16/2			F	10	"	"	18.50

*Deduct $3.00 if furnished less Par 38 Lamp **For use with cloth cutting machines and with hand power tools

Letters "JB" after series No. indicate that Cord Reel is equipped with arrangement with cover plate for mounting Reel on any overhead 4" octagonal outlet box.

Letter "T" after Model No. indicates that handle is equipped with a tool tap.

Series 700 Cord Reels have the exclusive and unique level-winder feature.

BENJAMIN ELECTRIC EXTENSION CORD REELS are available for Service Stations, Garages and Industry—Also available for original equipment purposes on Wringer Type Washing Machines, Floor Lamps, Ironers, Vacuum Cleaners, Projectors, Tape Recorders, Portable Television and Portable Radios, etc.

Series 200, 600, 700 and 3,000 BENJAMIN GROUNDING REELS for static discharge are available for bulk stations, terminals, airports, etc.

Prices are subject to change without notice, due to uncertain conditions in the material and labor market.

BENJAMIN REEL PRODUCTS, INC.

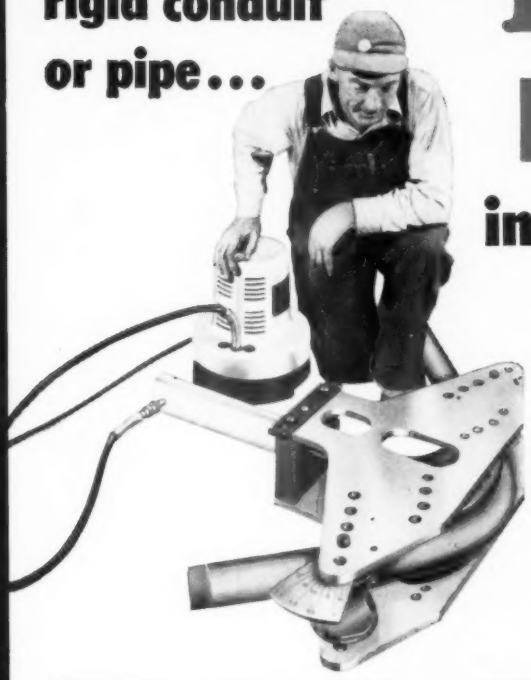
10700 BROADWAY • CLEVELAND 25, OHIO

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR Electric Company

For thin-wall or rigid conduit or pipe...



BLACKHAWK PIPE BENDERS

in *every* size and price range!

You look ahead to amazing savings when you look over the *world's most complete line* of pipe benders . . . yours from Blackhawk. First choice with electricians everywhere! Exclusive advanced designs do the hard work for you . . . pay for themselves in 2 or 3 jobs! Be prepared to save up to 77% over cost of manufactured ells.

New super-portable featherweight aluminum models are easiest to set-up! Make bends in 3" pipe in just *one bite!* Turn out neater, more accurate jobs in half of the time required by ordinary benders.

Check this chart now. Then select the Blackhawk that is *just right* for you.

MODEL	PUMP	DIAMETERS
S-30A	Hyd. hand pump	1, 1¼, 1½, and 2" rigid conduit and pipe
S-34	Hyd. hand pump	1¼, 1½, 2" thin-wall conduit
S-36	Hyd. hand pump	1¼, 1½, 2, 2½, 3, 3½; 4" rigid conduit and pipe
New S-130 1-bite	Hyd. hand pump	½ - 2" rigid conduit and pipe
New S-132 1-bite	Electric-powered pump	½ - 2" rigid conduit and pipe
New S-137 1-bite	Hyd. hand pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe
New S-138 1-bite	Hyd. hand pump	1¼, 1½, 2, 2½, 3" rigid conduit and pipe
New S-139 1-bite	Electric-powered pump	1¼, 1½, 2, 2½, 3" rigid conduit and pipe
New S-140 1-bite	Electric-powered pump	1¼, 1½, 2, 2½, 3, 3½, 4" rigid conduit and pipe

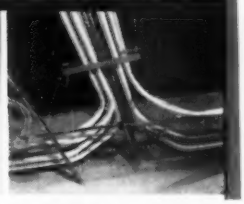
One bite does it! NEW Blackhawk aluminum benders slash costs 77%!

NEW S-130 FEATHERWEIGHT ALUMINUM BENDER for ½ to 2" pipe and rigid conduit—make full 90° bends in just one operation! Speeds making 180° bends, double offsets and compound bends. Cuts bending time in half! See for yourself! Try one on your next job.

NEW S-140 FEATHERWEIGHT ALUMINUM BENDER for up to 4" pipe — Electric power operated. A cinch for one man to assemble and carry right to the job! Bends up to 3" rigid conduit in one lightning pass! Only 3 quick setups are needed for 3½ and 4" 90° pipe bends.

EXCLUSIVE "OPTIK-ANGLE" GAUGE. A magical time and work saver! Gauge is mounted right on bending shoe to give exact degree of bend during bending operation. Gone are guesswork, time-wasting measuring for determining correct degree of bends!

ALUMINUM REMOVABLE TOP PLATE. "Lock-on" shoes — no threading of shoes on ram — simply place them in position and insert lock pin. Pipe is quickly positioned from above rather than "muscled" in from side. Top-plate has snap action, quick-lock bolt.



WHOPPING 77% SAVED ON BENDS! Dietz Electric Co., project foreman says, "Last job, we saved more than $2,000 compared to manufactured ells. From now on, Blackhawk S-139 is our production bender." Try Blackhawk . . . the fastest bender on the market today.

BLACKHAWK bends prove BLACKHAWK'S best!

SEE YOUR DISTRIBUTOR ... TODAY!

. . . choose from his *complete* Blackhawk stock!

BLACKHAWK

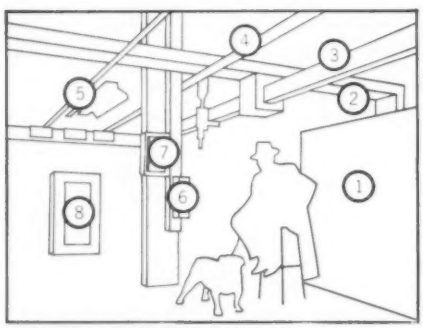
Blackhawk Mfg. Co., Dept. P-2048, Milwaukee 46, Wis.

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical

Electrical Planning—*key to efficiency and economy, too!*



PLANNED POWER on display—it's yours in a system of coordinated BullDog components. 1. Unit Substation and Unit-Versal® Switchboards. 2. Lo-X® Feeder Duct. 3. Plug-in® Duct. 4. Industrial Trol-E-Duct®. 5. Universal Lighting Duct. 6. Pushmatic Electri-Centers®. 7. Clampmatic® Safety Switches. 8. Power Panels.

Score yourself on how well you're using electricity. Is control and distribution of power getting its deserved emphasis in your plans and installations? Do your clients enjoy the benefits of a distribution system tailored to the needs of their operations—whether commercial, institutional or industrial? Such a system of BullDog equipment can provide greater efficiency, profitable use of personnel, and easy, economical growth.

Contact your BullDog field engineer or distributor for complete details on the advantages of a BullDog distribution system. Make sure your customers are powered up to meet a challenging future.

© BEPCO

BULLDOG

BullDog Electric Products Co., Detroit 32, Mich. A Division of I-T-E Circuit Breaker Co.
BullDog Export Division: 13 East 40th St., New York 16, N.Y.
In Canada: BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

To spot what's NEW and best for you **call GraybaR first for...** Everything Electrical GraybaR ELECTRIC COMPANY

SOLDER CONNECTIONS	LOOSEN RUSTED TERMINATIONS	SPLICE CABLES
MAKE RADIO REPAIRS	**MELT LEAD**	**BEND CONDUIT**

THE BERNZ-O-MATIC MASTER PROPANE TORCH

Do these and many other jobs FASTER...EASIER...

and more economically with Instant Lighting BERNZ-O-MATIC® MASTER TORCH with disposable propane gas cylinder

No longer do you have to worry about bulky tanks, tangling hoses, fuel spillage, pumping and priming torches.

Now, you can have a lightweight torch that you can easily carry about in your pocket or tool case . . . or clip to your belt for pole work.

The Bernz-O-Matic Master Propane Torch offers you a host of other advantages. It lights instantly . . . even at 30° below zero. It has a disposable propane gas cylinder that contains enough fuel for months of normal use. When the fuel is exhausted, simply throw the cylinder away and replace with another for the low price of $1.94 (retail). The torch itself retails for only $6.95.

There's another advantage to the cylinder, too. It seals itself, permitting you to change burners at any time during the life of the cylinder.

Accessories broaden uses of the torch

TX-2 • *Utility burner for* many general service uses. Permits attachment of flame spreader.

TX-300 • *Flame spreader* provides wide flame for burning off old paint for use with TX-2 burner unit.

TX-400 • *Small soldering tip* especially adaptable for soldering wires and other close electrical work for use with TX-10 torch.

TX-401 • *Large soldering tip* finds wide use in heavy-duty soldering for use with TX-10 torch.

TX-410 • *Floor stand* permits you to stand torch up while burning without fear of it falling.

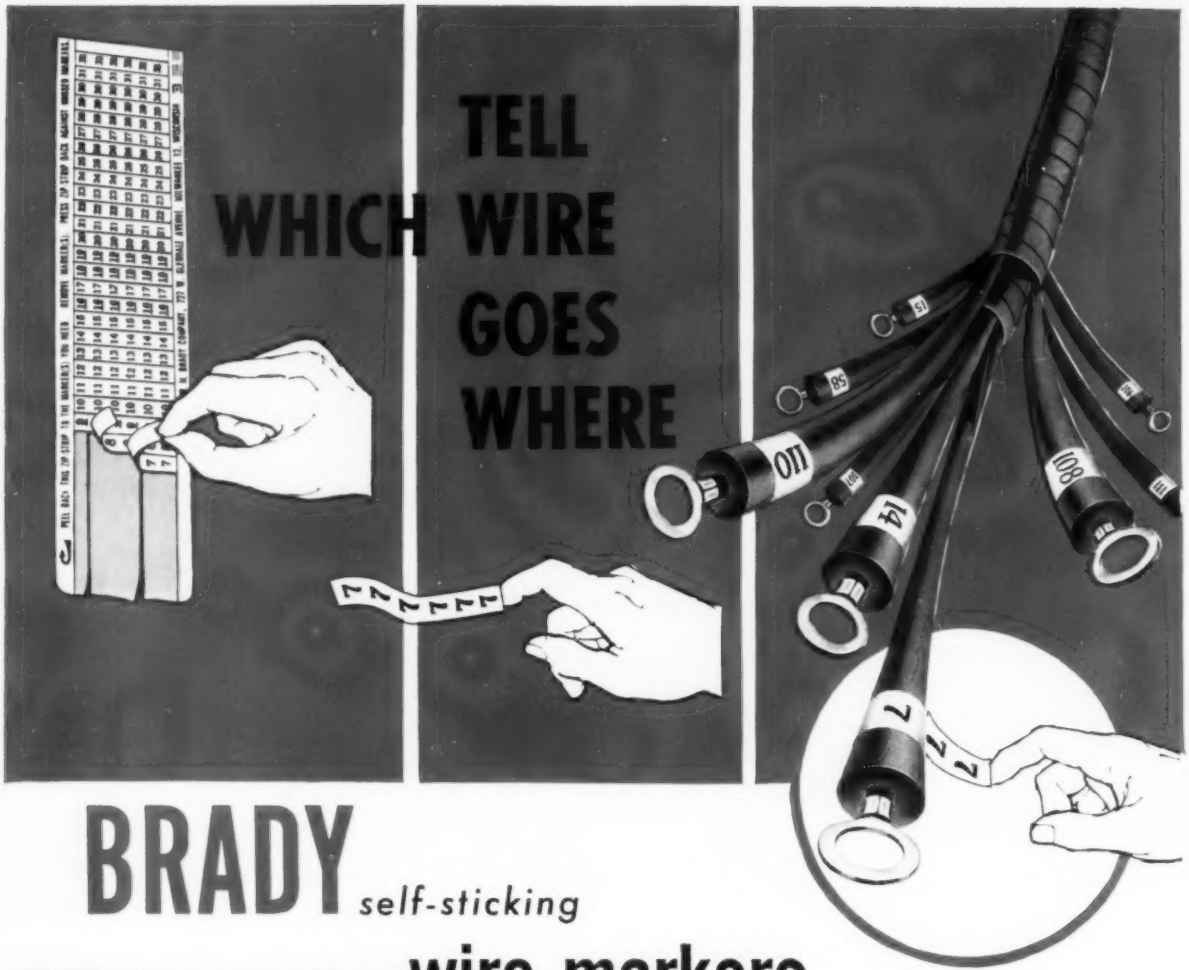
TX-405 • *Spark lighter* for quick lighting of torches.

THE MIRACLE OF MODERN CONVENIENCE

Sturdy, I.C.C. approved, 12 gauge steel cylinder contains enough fuel for months of normal use. Safety relief valve helps assure safe storage and operation. Self-sealing valve permits you to remove cylinder from burner at any time without loss of fuel. Cylinder interchangeable on all Bernz-O-Matic appliances (torches, stoves, lanterns). Not refillable. Replacement cylinder at new, low price of only $1.94.

"Always Reliable" **OTTO BERNZ CO., INC., Rochester, N. Y.** *"Since 1876"*

To spot what's NEW and best for you **call GraybaR first for...** Everything Electrical GraybaR



BRADY *self-sticking*

PERMA-CODE wire markers

Mark Wires Fast, Safe, and Sure

- ***Cut Costs*** — Cut costly labor expense you pay for ringing out, tracing, notching, tagging, guessing.
- ***Stick and Stay Stuck*** — All-temperature Markers hold firm at −300°F. Pulling through conduit won't loosen Markers.
- ***Flexible System*** — Conforms to NEMA-ASA Specifications and NMTBA Specs. Over 3000 different stock numbers to choose from.
- ***Positive Identification*** — Permanent around-the-wire identification in two stock lengths — ¾" and 1½" to fit different diameter wires.
- ***Local Delivery*** — Graybar stocks Brady Markers for local delivery in 100 principal cities.

BRADY WIRE MARKERS DO YOUR JOB BETTER — AT LOWER COST

ALL-TEMPERATURE VINYL CLOTH WIRE MARKERS

General purpose Markers. All NEMA symbols, letters and numbers in stock. Black legends on white background.

ALL-TEMPERATURE COLOR-CODE WIRE MARKERS

Gives you two-way identification — color and number. Numbers on all standard NEMA color backgrounds in stock.

FLAME-PROOF ALUMINUM FOIL WIRE MARKERS

Self-sticking 3 mil super-thin Markers hug wires tight in oily surroundings, elevated temperatures; won't discolor.

QUIK-SELECTOR BRADY-PAC

New easy-to-use dispenser carton holds 25 Brady Wire Marker Cards. Allows quick selection of Markers you want.

W. H. BRADY CO. Est. 1914

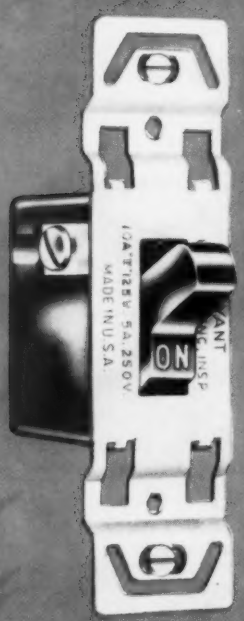
793 W. Glendale Ave., Milwaukee 9, Wis. • Manufacturers of Quality Self-Sticking Industrial Products

To spot what's NEW and best for you

call GraybaR first for...

GraybaR *Everything Electrical* GraybaR ELECTRIC COMPANY

Built to last a house-time



...the new "T"-rated switch from Bryant

For economy plus Bryant dependability, try this switch on your next job. It fills the bill for most residential installations. COMPACT—plenty of wiring room. STRONG—built to last a house-time. HANDY—captive mounting screws make installation easy. SAFE—fully enclosed operating parts. STURDY—large yoke with more exposed plaster-ear area. *Available now at your Bryant Distributor.*

Bryant introduces the newest addition to its complete line of moderately priced wiring devices. It's the new Bryant No. 6001 wall switch. Available with brown or ivory handles . . . single-pole or 3-way.

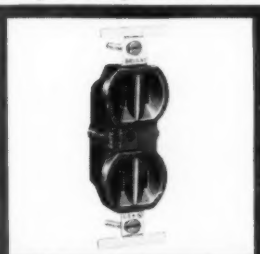
This new switch gives you the Bryant name . . . Bryant quality at competitive prices. Now—more than ever—you can wisely use Bryant on every job you wire.

Bryant's broad, complete line of wiring devices is designed to meet the specific needs of contractors and electricians on every job. Faster, easier installation . . . highest quality. And Bryant not only meets but exceeds Federal and Underwriters' Laboratories Standards. Make Bryant first choice . . . there's no need to change brands or distributors from job to job.

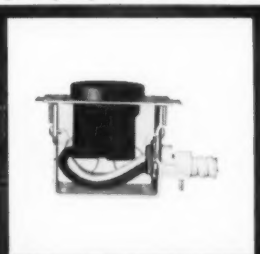
See the new No. 6001 at your Bryant Distributor . . . and the complete Bryant line. J-99993-R

Complete the job with these quality Bryant devices . . . BUILT TO LAST A HOUSE-TIME

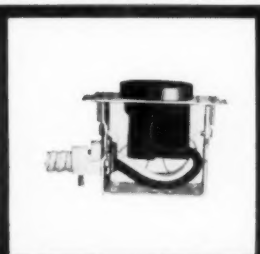
No. 5252 grounding duplex outlets.



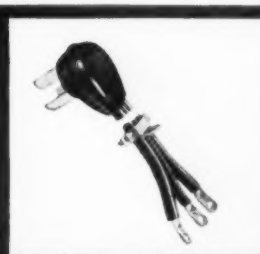
No. 6142 duplex outlet.



No. 9303 three-wire polarized connector.



No. 9306 heavy-duty three-wire polarized connector.



No. 3830 three-wire polarized cord sets.

THE BRYANT ELECTRIC COMPANY
BRIDGEPORT 2, CONN. • CHICAGO • LOS ANGELES

BRYANT
SUPERIOR WIRING DEVICES

To spot what's NEW and best for you

call GraybaR first for . . .

Everything Electrical GraybaR

FOR VOLTAGES UP TO 600...

There's a *Safe and Dependable* BUSS Fuse or FUSETRON Fuse to fit the needs of every user

If you want Plug Fuses . . .

Use BUSS Clear Window Plug Fuses

Their one-piece body and "safety" design guarantees protection.

They are most convenient to use too, because real big windows and white backgrounds permits entire fuse strip to be seen. Even in poor light a blown BUSS fuse is easy to find.

If you want to make safe protection REMAIN SAFE as well as REDUCE blowing fuses . . .

Use BUSS Fustats (have Type S base)

FUSTATS like Fusetron Fuses have a dual-element and therefore, stop needless blowing — and they do more.

They have a type S base that prevents anyone from replacing them with a penny or substitute — or using a size too large to protect.

FUSTATS fit standard plug fuse holders by means of an inexpensive adapter that locks in place and needs never to be replaced.

If you want to reduce blowing of Plug Fuses . . .

Use FUSETRON dual-element Plug Fuses

FUSETRON Plug fuses protect like ordinary fuses against short-circuits and overloads — but unlike ordinary fuses they won't blow on motor starting currents or other harmless overloads.

They are the type of fuses recommended in the 1953 National Electrical Code.

Tc protect motors and apparatus of voltages up to 125 against burnout . . .

Use 0 to 14 amperes BUSS Fustats

A FUSTAT of the proper size installed to handle only the motor current will reduce to a minimum the chance of a motor burnout from an excessive over-current. In like manner it will protect solenoids, coils and transformers against burnout.

FUSTATS have the same degree of Underwriters' approval for both motor-running and short-circuit protection as the most expensive devices made. They give all the protection it is possible to obtain with any device on the market.

FUSES! . . . THE SAFEST AND MOST DEPENDABLE PROTECTION YET DEVISED!

A fuse has just one vital part — a thin narrow strip of fuse metal. When the heat of a short-circuit is applied, the fuse link must melt and open the circuit.

The high speed operation of the fuse reduces to a minimum the danger of short-circuit damage to wiring and equipment.

Fuses offer dependable protection over the years.

The fuse link is sealed in. Dust can't get at it. Corrosion or oxidation can't increase its capacity or lengthen its blowing time.

There are no hinges, pivots or contacts to stick or get out of order.

Millions of fuses have been in operation 30 years or more, because there has been no trouble on the

Play Safe! Install BUSS Fuses or

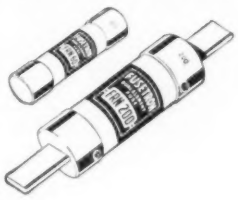
To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical GraybaR

If you want fuses that — abolish all needless blows, stop overheating in panels and switches, protect motors against burnouts . . .

Use FUSETRON dual-element Fuses



With rare exceptions, ordinary fuses or circuit breakers do not protect except against short-circuit but FUSETRON fuses provide TEN POINT protection.

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

FUSETRON duel-element FUSES save you time and money because they are made to PROTECT — not to blow.

If you want Non-Renewable Fuses . . .

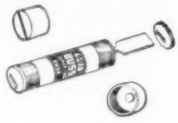
Use BUSS One-Time Fuses

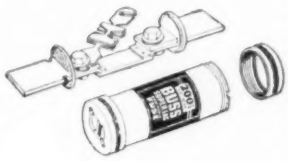
They save you time and trouble because they get the same engineering care in manufacture as do all products carrying the BUSS Trademark.

Every BUSS One-Time fuse can be depended upon to operate as intended under all service conditions.

If you want Renewable Fuses . . .

Use BUSS Super-Lag Renewable Fuses





The big advantage of these fuses over all other renewable fuses comes from the prevention of useless interruptions of service caused by needless blows.

The reason for this performance is found in the design of the fuse-case which assures good contact on the fuse link, even if the fuse is renewed by an inexperienced person — and by the time-lag built into the link that prevents the fuse from opening on motor starting currents or other harmless overloads.

If you want SAFE protection on loads above 600 and up to 5000 amps . . .

Use BUSS Hi-Cap Fuses

On voltages up to 600, high speed operation on heavy shorts limits current to safe values. This minimizes damage to equipment and cuts down dangerous stresses on transformers.

For Short-Circuit Protection or when fast opening is desired . . .

Use BUSS Limitron Fuses

The extremely fast opening characteristics of these fuses prevent heavy short-circuit currents from building up under fault conditions.

For protection of TV, Radio, Instruments, Radar, Avionics and Electronic Equipment . . .

Use BUSS and FUSETRON Small Dimension Fuses

A complete line is available. Made in Dual-element (slow-blowing), Renewable and One-Time types in sizes from 1/500 ampere up.

And there is a companion line of BUSS Fuse Clips, Fuse Blocks and Fuse Holders to take them.

circuits they are protecting and therefore no occasion to open.

Yet, after years of inactivity, you can be sure the fuse will give the same safe, dependable protection if called upon to open as it would have on the day it was installed.

NO RECALIBRATION COSTS

When Fusetron fuses do blow, there is no recalibration needed. As quickly as the fault in the circuit is corrected, you slip in a new fuse that has been CALIBRATED AT THE FACTORY BY ENGINEERS — a fuse that is as safe and dependable as the one that blew.

Fusetron Fuses Now! THROUGHOUT THE ENTIRE ELECTRICAL SYSTEM

FOR MORE INFORMATION ON BUSS AND FUSETRON FUSES WRITE TO BUSSMANN MFG. DIVISION McGRAW-EDISON CO. ST. LOUIS 7, MO.

FUSETRON

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

453

To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical

Cordley's

complete line makes it easy to specify the right Cooler

BECAUSE THERE'S A CORDLEY WATER COOLER
Quality-Built To...

- fit any budget
- serve any location
- give any capacity (2 gals. to 27 gals. per hour)
- meet any water cooling need

CORDLEY COMPACT LINE

Just 12" square. Models in the Compact line are recommended wherever floor space is at a premium.

Model H-3S
Compact design, but big-cooler capacity.

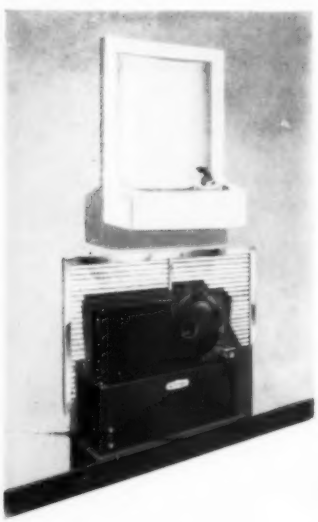
Model G-2S
Takes 1, 2, 3 or 5 gallon bottle. For use where municipal water is unavailable or unacceptable.

CORDLEY STANDARD LINE

Air-cooled, water-cooled and explosion-proof models available

Bubbler Type
Dual hand and foot controls work mechanically. Deliver water even when power fails. Available in 5 to 27 gallons-per-hour capacities.

Model HC-5
With standard household refrigerator compartment. Stores cold drinks, make two trays of ice cubes. Also available in bottle type.



CORDLEY "WALL-HIDE"

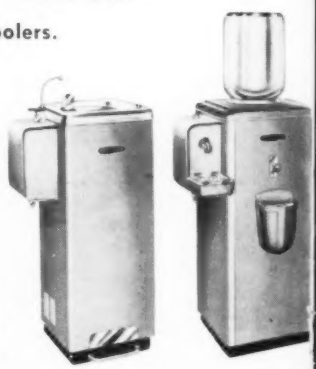
in-the-wall remote cooler

Just 6¾ inches deep, allows installation in all modern hollow wall construction. Four other remote coolers are available in capacities from 5 gallons to 24 gallons per hour.

NEW! CORDLEY "HOT TAP"

Hot water attachment for coolers.

Converts existing bottle and bubbler coolers to double-duty service. "Hot Tap" is quickly and easily attached to water cooler. Makes plenty of piping hot water for instant coffee, tea, etc.



Also Available

Cordley Hot and Cold Water Dispensers. Give refreshing cool drinking water *plus* hot water for instant hot drinks. Two bottle models.

Ask your Graybar salesman to give you full details on the Cordley Quality line of Water Coolers. Or write for Catalog 58.

Cordley
NEW YORK

Since 1889 . . . First in water coolers . . . Over 1,000,000 sold

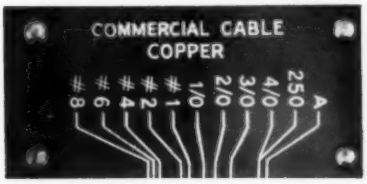
To spot what's NEW and best for you

call GraybaR first for . . .

GRAYBAR Everything Electrical GraybaR ELECTRIC COMPANY

MY29-3 HYTOOL connects copper and aluminum...without changing dies!

No die inserts to change . . . to identify . . . to store or mislay! A twist of the wrist, and you're ready to connect *any* of the wire sizes #8 thru 250 copper . . . #8 thru 4/0 aluminum . . . with a single stroke! The cable-size scale (below) positions the nest die for copper. An aluminum scale on reverse side of tool doubles its versatility. MY29-type Hytools also install mining, aircraft, flexible and extra-flexible cable, and other special conductors.



This rugged, lightweight tool is inexpensive, too

only . . . $36.00

Ask your Burndy distributor for a demonstration.

BURNDY

Norwalk, Connect. • Toronto, Canada

56-23C

To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical GraybaR

DAY-BRITE TROFFERS

New Day-Brite Recessed Troffers are shallower and lighter, yet stronger. Exclusive UNI-FORM design combines body and reflector in one-piece unit. Available for all plaster and acoustical ceilings.

Simple, functional lighting by Day-Brite was the logical choice for the Accounting Department of the new Chicago Sun-Times Building. NAESS and MURPHY, *Architect-Engineers.* GEORGE A. FULLER CO., *General Contractor.* WHITE CITY ELECTRIC CO., *Electrical Contractor.*

...selected for the world's most efficient newspaper plant

HERE'S WHY: Day-Brite Troffers offer all of the cost-saving advantages provided by modular construction.

With weight reduced as much as one-third, installation is safer and faster . . . with less ceiling load.

Shallow dimensions allow for greater freedom of placement and simplify mechanical planning.

Designed with adjustable suspension features, separable hinges, plenty of knock-outs . . . and factory pre-assembled to save time on the job.

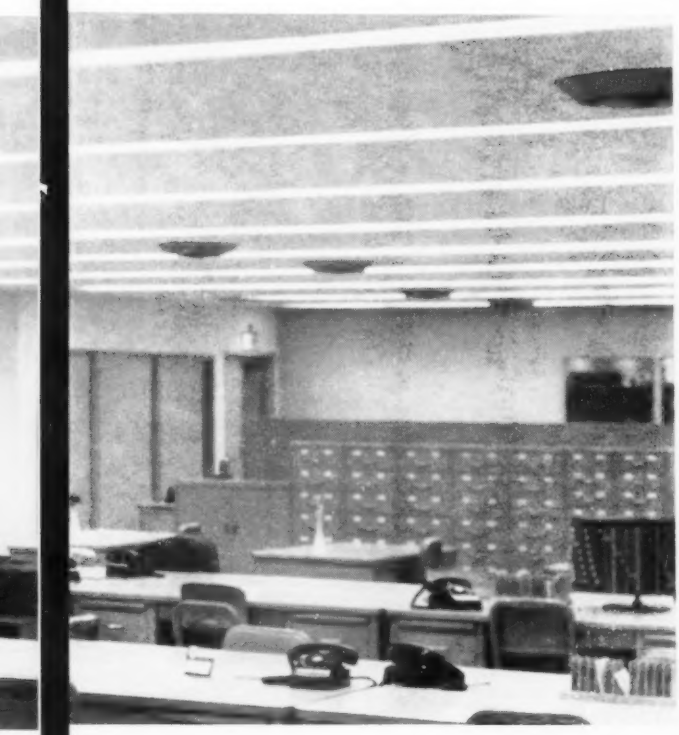
Want more details? Write for your copy of 16-page, illustrated booklet on *Modular Lighting.* Or call your Day-Brite representative listed in the Yellow Pages.

Recessed Troffers deliver high lighting levels with low brightness in the Sun-Times Public Service Department.

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY



DAY-BRITE...the Contractor's Choice

Harvey T. Nack, Jr. and Bernard L. Padgett of White City Electric Co.

"It's a pleasure to install DAY-BRITE"

...says HARVEY T. NACK, JR., President
White City Electric Company
Chicago, Illinois

"Day-Brite fixtures always arrive on the job looking good. They're easy to unpack and handle . . . all parts are included, and there's a minimum of breakage.

"They go up easy and stay put. Call-backs are practically unheard of.

"It's a pleasure to install Day-Brite, the leader in the lighting field. Day-Brite stands firmly behind their product and their field representatives who, incidentally, provide the finest service in the industry." Z-152

DECIDEDLY BETTER
DAY-BRITE
Lighting Fixtures

Day-Brite Lighting, Inc.,
6248 N. Broadway, St. Louis 15, Mo.

Day-Brite Lighting, Inc.
of Calif., 530 Martin Ave., Santa Clara, Calif.

Certified Lighting for a Better America

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

Coffing Hoists for Safety and Economy

Quik-Lift Electric Hoists

A complete line of 24 models with capacities from 500 to 5000 pounds. Most capacities offer choice of cable or coil chain with two or more lifting speeds.

Super Power Coil Chain Hoists

Compound lever and ratchet-and-pawl construction make them lightest, safest, most efficient hoists in their class. Six models in capacities from 1½ to 5 tons—1½ and 3 ton in aluminum as well as malleable iron.

Safety Pull Roller Chain Hoists

Ratchet-and-pawl construction assures safe operation, and "Safety Valve" handle gives before any load-bearing part can fail—warning operator. Ten models in capacities from 1½ to 15 tons.

Challenger Spur Gear Hoists

Light-weight and dependable, the Challenger is available in ½ and one ton capacities. Durable construction and sealed-in lubrication reduce maintenance costs to a minimum.

Mighty-Midget Pullers

Light and compact—500 pound model weighs but 6½ pounds, 1000 pound model but 9½. Handle can be used either as a lever or a high speed crank.

Duff-Norton Jacks Save Time, Energy and Money

Pole-Pulling Jacks

Duff-Norton pole-pulling jacks will pull or straighten utility poles without laborious digging. Hinged channel base permits jack operation at an angle or upright as required. Service need not be interrupted when these jacks are used.

Cable Reel Jacks (single action)

Jacks are equipped with adjustable cable reel lift incorporating a steel hook which can be placed at any point on the lifting rack. Reels of different diameters can be picked up at any height. Five ton model 524MCR is especially adaptable to warehouse use for handling cable, wire, hemp rope, leather belting and the like.

DUFF-NORTON

Duff-Norton Company

MAIN PLANT AND GENERAL OFFICES: PITTSBURGH 30, PA

CANADIAN PLANT: TORONTO, ONT.

Coffing Hoist Division • DANVILLE, ILLINOIS

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR

Now, more than ever, engineers specify: "CONDULETS*... or approved equal"

After 51 years of use in every conceivable application, Condulets remain the standard of quality for rigid conduit fittings.

It's not hard to see why. Pick up any Obround Condulet, for example, and note such features as these:

TAPER TAPPING: Condulet threads are taper tapped to match tapered conduit threading . . . giving you a rigid joint that will not loosen . . . insuring *permanent* ground continuity!

INTEGRAL BUSHING: A smooth, rounded, burr-less surface that protects wire insulation.

WEDGE NUT COVER FASTENER: This exclusive Crouse-Hinds feature is part of the cover itself. Screws can't fall out. No screw holes to locate. No protruding screw hole ears to damage cable.

LONGER HUBS: Conduit can be tightened completely without bottoming on integral bushing. And there's generous surface space for good wrench hold.

MATERIAL: Feraloy, a special alloy that is strong and tough, resists corrosion . . . gives sharp, full threads.

FINISH: A triple-layer treatment that exceeds Federal and U.L. specs for longer-lasting protection.

Where else can you find all (or even *most*) of these features? You *can* find them all in each of the 43 types of Obround Condulets . . . sizes ½" to 6".

There is a type for every need, including a wide selection of interchangeable covers and wiring devices. Just call your Crouse-Hinds distributor and ask for "Condulets!"

*CONDULET is a coined word registered in the U.S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

CROUSE HINDS

MAIN OFFICE AND FACTORY: SYRACUSE, NEW YORK

Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

● CONDULET® ELECTRICAL EQUIPMENT (Explosion Proof and Conventional) ● FLOODLIGHTING
● TRAFFIC CONTROL SYSTEMS ● AIRPORT LIGHTING and WEATHER MEASURING EQUIPMENT

These products are sold exclusively through electrical distributors. For application engineering help, contact one of the following offices: Boston, Buffalo, Birmingham, Boise, Chicago, Cincinnati, Cleveland, Corpus Christi, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, St. Louis, St. Paul, San Francisco, Seattle, Tulsa, Washington. Resident Representatives: Albany, Atlanta, Baltimore, Charlotte, Chattanooga, Jacksonville, Pensacola, Fla., Richmond, Va., Shreveport.

To spot what's NEW and best for you

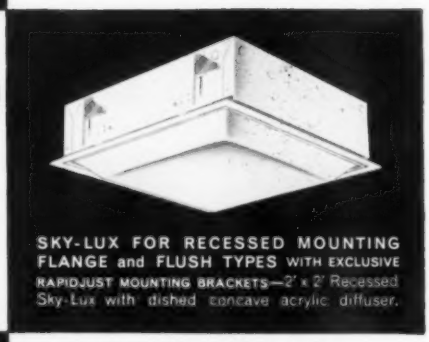
call GraybaR first for...

GraybaR Everything Electrical GraybaR

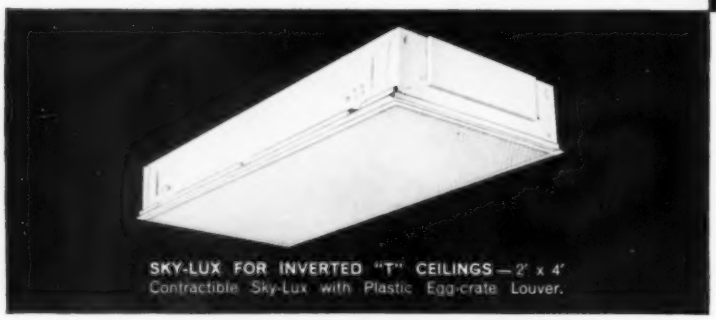
SKY-LUX FOR SURFACE MOUNTING—4′ x 4′
Surface Sky-Lux with CurtiCell louver-diffuser.

WHAT IS "MOST WANTED" IN COMMERCIAL LIGHTING?

- *Quality Illumination*
- *Appearance*
- *Minimum Maintenance*
- *Long-Run Economy*
- *Easy Installation*
- *Low Initial Cost*



SKY-LUX FOR RECESSED MOUNTING FLANGE and FLUSH TYPES WITH EXCLUSIVE RAPIDJUST MOUNTING BRACKETS—2′ x 2′ Recessed Sky-Lux with dished concave acrylic diffuser.



SKY-LUX FOR INVERTED "T" CEILINGS—2′ x 4′
Contractible Sky-Lux with Plastic Egg-crate Louver.

SKY-LUX LARGE AREA LUMINAIRES

Modularly designed luminaires providing controlled high-level illumination. SKY-LUX series luminaires, designed for use in all ceiling types, produce a lower, more dramatic ceiling effect for today's commercial interiors. Surface, Contractible and Recessed SKY-LUX Luminaires are available in 2′ x 2′, 2′ x 4′, 4′ x 4′ sizes with choice of White CurtiCell, Plastic Egg-crate Louver, Concave, Dished Concave and Flat Acrylic Plastic Diffusers, Alba-Lite Glass, Hexcel Honeylite and Corning No. 70 lens.

CURTIS

SKY-LUX LUMINAIRES MEET EVERY REQUIREMENT

Research proves that architects, engineers and building owners agree that commercial lighting must fulfill the demands for: *Quality illumination . . . Long-Run Economy . . . Appearance . . . Easy Installation . . . Minimum Maintenance . . . Low Initial Cost.* Curtis Sky-Lux Luminaires were engineered and designed with these specifications in mind. Moreover, when adapted to modern low-ceiling construction, Sky-Lux units assure high-level illumination, properly diffused general lighting, and unmatched overhead beauty. So, profit from the popularity of Curtis Sky-Lux Luminaires among those who know commercial lighting best. Curtis Lighting, Inc., 6135 W. 65th Street, Chicago 38, Illinois. In Canada: 195 Wicksteed Avenue, Toronto 17, Canada.

CURTIS

Visioneers in Planned Lighting®

To spot what's NEW and best for you

call GraybaR first for . . .

Everything Electrical GraybaR

new design

DHD®

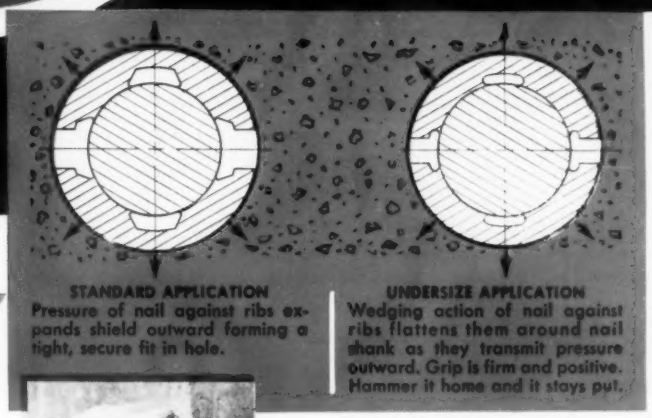
Hammer Drive Anchors

are easier to drive
...hold more weight

The DIAMOND DHD Hammer Drive Anchor, standard masonry fastener for the telephone and utility fields for nearly 30 years, has now been greatly improved with a newly engineered design, featuring

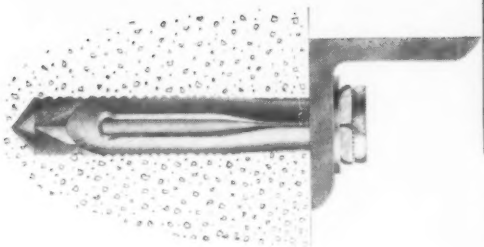
Internal Ribbed Construction

The addition of these ribs provide variable radial expansion for tight fit regardless of variation in hole size, developing the greatest *sustained* holding power ever possible. Aluminum anchor and hot dipped galvanized nail — a completely rust-proof anchoring unit.



STANDARD APPLICATION
Pressure of nail against ribs expands shield outward forming a tight, secure fit in hole.

UNDERSIZE APPLICATION
Wedging action of nail against ribs flattens them around nail shank as they transmit pressure outward. Grip is firm and positive. Hammer it home and it stays put.



Metal Won't "Creep"

Special aluminum alloy shield can't "creep". Because of this, the DHD Anchor withstands amazingly high sustained loads. DIAMOND also supplies a complete line of masonry drills and accessories. All products are sold through qualified distributors. Call or write for information today.

DIAMOND EXPANSION BOLT CO., INC.
500 North Avenue • Garwood, New Jersey

Stocking Warehouses: Atlanta, Boston, Chicago, Dallas, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, St. Louis, Washington, D. C. Also, Montreal, Toronto and Vancouver, Canada.

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR

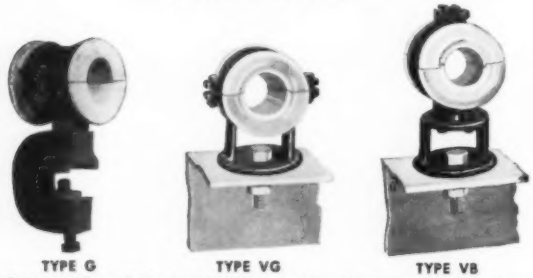
Efficiency

SUSPENSION DEVICES

ARE TIME AND COST SAVERS

By eliminating the need for punching, drilling or burning through beams in order to hang electrical mountings . . . Efficiency Suspension Devices can save you time and expense on practically every construction job.

BUSHING SUPPORTS

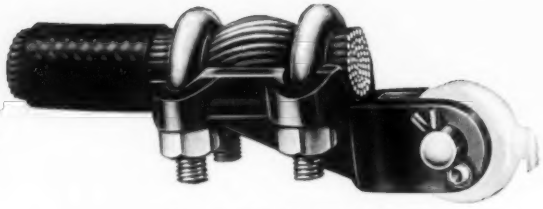


TYPE G | TYPE VG | TYPE VB

Designated to eliminate the drilling of holes for mounting, these supports are adjustable to any angle. Made of malleable iron with highest quality split porcelain, they are furnished for AC-DC service to handle 5/16" to 2⅜" cable. Type G is clamp-mounted while Type VB and VG bolt mounted through its circular base.

BUSHING RACKS AND SUPPORTS

Available in 2, 3, 4, 5 and 6 bushing racks for AC or DC service. Only a single bolt is required to support the bushing and clamp the support to the rack. For 5/16" to 2⅜" wire sizes.

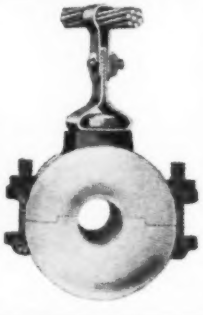


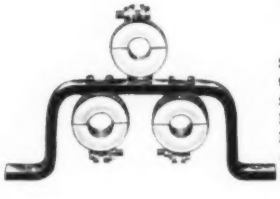
CABLE STRAIN CLAMP

Capable of withstanding a direct pull of over 12,500 lbs. before slipping, this clamp can be furnished either with eye or clevis. Three clamp sizes accommodate all cable sizes from 1/0 to 1,500,000 c.m. Constructed of malleable iron, this clamp has a high ridge across the center of the cable channel and a U-bolt at each end.

BUSHING MESSENGER SUPPORT

This support is designed to suspend wire or cable from messengers where beam mounting is not possible. This support is a combination of our Type G Bushing Support with strip steel messenger attachment. Furnished complete with malleable iron support, steel messenger attachment and all bolts, as illustrated.



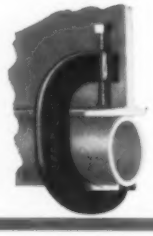


NESTED BUSHING RACKS AND SUPPORTS

Simply and compactly designed to carry conductors equidistant from center to center. Each bushing is a separate unit, allowing independent installation of each cable line. Available in 2, 3, 4, 5 and 6 bushing racks.

NON-ADJUSTABLE INSULATOR SUPPORT

ADJUSTABLE INSULATOR SUPPORT



CONDUIT HANGERS

Correctly designed for carrying armored cable or ½" to 2½" pipe along open steel construction. Radiating ridges and the five point gripping surface keeps the pipe suspended dead center, with the set screw above permitting the cable or pipe to be carried at any angle. Made of highest quality malleable iron.

EFFICIENCY ELECTRIC AND MANUFACTURING COMPANY

Write for Catalog — EAST PALESTINE, OHIO

To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

you get EXTRA PROTECTION
plus Extra Economy with
ECONOMY FUSES

Economy Fuses give you Extra Protection with such built-in superiorities as:

Specially Developed Metal Alloys
These alloys, because they are developed to meet specific requirements, assure "quick as a wink" action when the danger point is reached. Yet they also assure extra protection against needless fuse blows due to sudden power surges or current fluctuations.

In addition to this extra protection, Economy brings you the extra advantage of a

Complete Line of Fuses
Nearly 400 types, sizes and capacities enable you to select exactly the right fuses, specially engineered to best meet your requirements.

Extra Protection *plus* Complete Line Selection add up to extra economies such as:

- Reduced fuse replacement costs
- Fewer repairs
- Longer life for electrical equipment
- Reduction of work stoppages due to fuse blows

NEARLY 400 TYPES, SIZES AND CAPACITIES

ECO® ONE-TIME CARTRIDGE FUSES
Knife blade and ferrule types, sizes from 2" to 13¾" and up to 600 amps for both 250 and 600 volts.

ARKLESS® MECHANICAL INDICATING FUSES
Knife blade or ferrule types, sizes from 2" to 13¾"; up to 600 amps in both 250 and 600 volts.

DELAY® RENEWABLE CARTRIDGE FUSES
Knife blade or ferrule types, sizes from 2" to 13¾"; to 600 amps, 250 volts and 600 volts.

ECONOMY RENEWABLE PLUG FUSES
Available in standard and sub-standard sizes, from 10 to 30 amps for 125 volts.

CLEARSITE® PLUG FUSES
Available in both standard and sub-standard sizes; from 1 to 30 amps.

ECON® DUAL-ELEMENT CARTRIDGE FUSES
Knife blade and ferrule types; from 0 to 600 amps, 250 and 600 volts.

ECONOMY FUSTATS
Resist tampering and over-fusing. Available from 1 to 30 amps.

ECONOMY FUSE PULLERS
Treated and sealed to minimize moisture absorption. Withstand breakdown test of 35,000 volts dry.

ECONOMY CLIP-TITE
Positive protection insures tight electrical contacts of fuse clips. Prevents heating of contacts.

Economy Trade Name fuses carry full Underwriters' Laboratories approval and listing.

SEND TODAY *for your FREE Economy Fuse Folder No. 3. This handy size folder lists the nearly 400 sizes, types and capacities of fuses available.*

ECONOMY FUSES FOR EVERY PURPOSE

R-150R

ECONOMY FUSE & MFG. CO., 2717 Greenview Ave., Chicago 14, Ill.

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

This is a distributor.

"Heads-up team play got this job."

Unique ALLERTON HOSPITAL, *designed "in the round," under construction last November in Brookline (outside of Boston), Massachusetts. Ed Coughlin, left, confers with electrical foreman George Taylor and Edwards salesman Walter Ames before concrete is poured for second level.*

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

To win contracts like the electrical installation at Allerton Hospital, Graybar salesman Ed Coughlin *works in close harness with his company's specialists, with contractors, and with manufacturers' salesmen. Here's Coughlin's system —*

"First news of a big job might come from a contractor," says Ed Coughlin, "as was the case with Allerton Hospital, or from one of the many architects and electrical engineers I know, or from a manufacturer's salesman who has good professional contacts himself." Then specs must be gone over, equipment details and prices completely worked out in consultation with contractor, with Graybar specialists, and sometimes with manufacturers' salesmen. This job requires speed, accuracy, and a tremendous fund of product information.

"We have built a reputation for knowing all there is to know about the products we handle," says *Edward E. Martin*, New England Manager, Graybar Electric. "We back our sales force with expert technical departments, and our salesmen attend regular classes. Signal equipment, which was important for Allerton Hospital, is a good example of how we work. We go after signal business because it is profitable. Signal equipment is important in our classes."

When a job reaches bid stage, Graybar signaling specialist *George Milligan* is the one who prepares "package" list of equipment and prices to be sent to contractor. Coughlin then makes follow-up calls on contractor, perhaps also on engineer; or he may ask Walt Ames, salesman for the equipment manufacturer, to discuss signaling with architect or engineer. "There isn't an angle left untouched," says specialist Milligan. "This is a complete, cooperative, follow-through system, the kind that's vital to distributing equipment such as signaling systems."

This combination of distributor salesman, distributor specialist, and manufacturer's salesman provides technical service and sales follow-up, and is appreciated by engineer and contractor. *George Taylor*, foreman for contractors J. & J. Electrical Company, Boston, puts it this way: follow-up by Coughlin and Ames is "a big help in getting the system in right."

Says *Walter Ames*, Edwards salesman, "It's up to me to coordinate my efforts (aimed primarily at architect and engineer) with the efforts of distributor salesmen like Ed Coughlin, as they sell the contractor on the whole job. I back up Ed with information and sales help when he calls for it. Occasionally I may follow up on the job. When the work is complete I may, for example, tour the signaling systems with the local fire chief, and instruct the responsible personnel in using the systems to full advantage."

The Edwards Company believes that distributors have an important but sometimes under-rated job to do in the electrical industry. Often we run across men in distribution, like Ed Coughlin and his associates at Graybar in Boston, who are doing their job very well indeed. We're glad to be able to relay their ideas.

4 Edwards signal systems at new Allerton Hospital

Allerton Hospital is a unique construction "in the round." Patients' rooms will all be placed around outside wall of the circular structure; nurses' stations, elevators, utilities, and service facilities will occupy the hub of the wheel.

Ed Coughlin of Graybar worked out with Walt Ames of Edwards the components for these signaling systems which will appear in the finished building:

1. *Four* call systems — nurses' call, surgical, delivery-room, and nursery calls.

2. A complete modern fire alarm system, with both manual pull-boxes and automatic heat detectors. It is coded, and electrically supervised, with a pre-signal and with connection to municipal fire headquarters.

3. A complete synchromatic clock system, centrally controlled, with each clock built around a Telechron® dual-motored unit to assure trouble-free service.

4. A pharmaceutical burglar alarm, specifically recommended by Ames and Coughlin for this application, using standard Edwards components throughout.

EDWARDS

specialists in signaling since 1872

Edwards Company, Inc.,
Norwalk, Connecticut
In Canada: Edwards of Canada, Ltd.,
Owen Sound, Ontario

To spot what's NEW and best for you

call GraybaR first for . . .

Everything Electrical GraybaR

Outside or Inside

13.2 KV/240 volt transformer substation for Mayville Metal Products Company, Mayville, Wis.

Built by 3E for a large automobile plant, this switching center handles a 4800 volt input. Using Auto-Speed Load Interrupter switches, it distributes power to a 200 HP and two 300 HP motors used to drive high frequency generators.

See 3E...for safe, efficient high voltage equipment

SUBSTATIONS. 3E's complete service provides: *Engineers* who have built substations of all sizes and for all kinds of uses . . . specialists in circuitry, switchgear and structure. A wide variety of outdoor *switches* designed and built at 3E . . . we can recommend without partiality the exact type of switch you should have. *Fabrication facilities* that deliver a substation packaged for easy, erection.

SWITCHING CENTERS. Whatever your requirements —rigid space limitation, portable units, corrosive or dusty atmosphere, or a foresighted design that will meet tomorrow's expansion needs . . . 3E has the range of products and the designers to give you the ideal equipment for your plant.

Some typical 3E switches and auxiliary equipment....

ISOLATORS

The famous straight-line-action switch. A 3E exclusive—takes only ⅓ the space needed by comparable knife type switches—rated to 15 KV in both disconnects and air interrupters.

ISO-DUCTS

A combination of compact modern ducts and ISOLATORS — ideal for future extension in either direction—any number of potheads and ISOLATORS can be combined and interchanged.

AIR INTERRUPTER SWITCHES

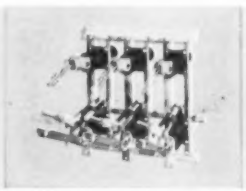
With safe Auto-Speed interruption — independent of operator speed. Arc is gas extinguished by dry-type interrupter on each pole — cost less than circuit breakers.

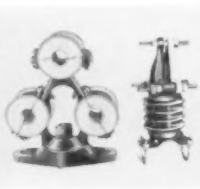
CLAMP INSULATORS AND BUS SUPPORTS

Wide range of sizes and types in rugged modern designs. Built of finest materials and designed for rapid safe installation. Prompt delivery from large stocks.

A REPUTATION

. . . for building equipment with an extra margin of safety. For almost 50 years the 3E name has meant conscientious engineering —safe construction.





3E

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois

To spot what's NEW and best for you

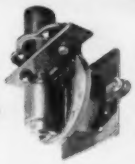
call GraybaR first for...

GraybaR Everything Electrical GraybaR

FEDERAL

Creators of SUPERIOR SIGNALS

INDUSTRIAL SIRENS



CHIMES

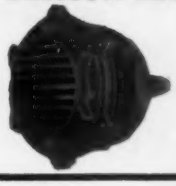
HEAVY DUTY BELLS

- OVER 50 YEARS EXPERIENCE
- ADVANCED LABORATORY AND PRODUCTION FACILITIES
- MOST COMPREHENSIVE LINE

JUST INTRODUCED the *new* MASTER BEACON RAY model #271. A new concept in visual signalling.

For widest selection and best technical information — you can count on FEDERAL! Our catalog #100, available for the asking, can help you in making a proper selection. It's introductory bulletin #100 can make you an expert on signals. Write for it today! WATCH FEDERAL FOR OTHER *NEW* ADVANCES.

MASTER BEACON RAY



ELECTRIC HORNS

RESONATING HORNS

AIR HORNS

MUNICIPAL SIRENS

FEDERAL SIGN and SIGNAL Corporation

8726 S. State St.,. Chicago 19, Ill.

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR

CONTROLLED LIGHTING

All-Brite
LIGHT OF THE WEST

With this array of NEW All-Brite products, added to the wide range of famous All-Brite lighting tools, YOU are the master of any lighting problem. Depend on All-Brite superior design, research and engineering for fullest control of commercial, industrial and institutional illumination.

All these are NEW, plus a full NEW line of hanging accessories. Ask for details.

write for catalogs and name of your local All-Brite representative

FLUORESCENT FIXTURES OF CALIFORNIA

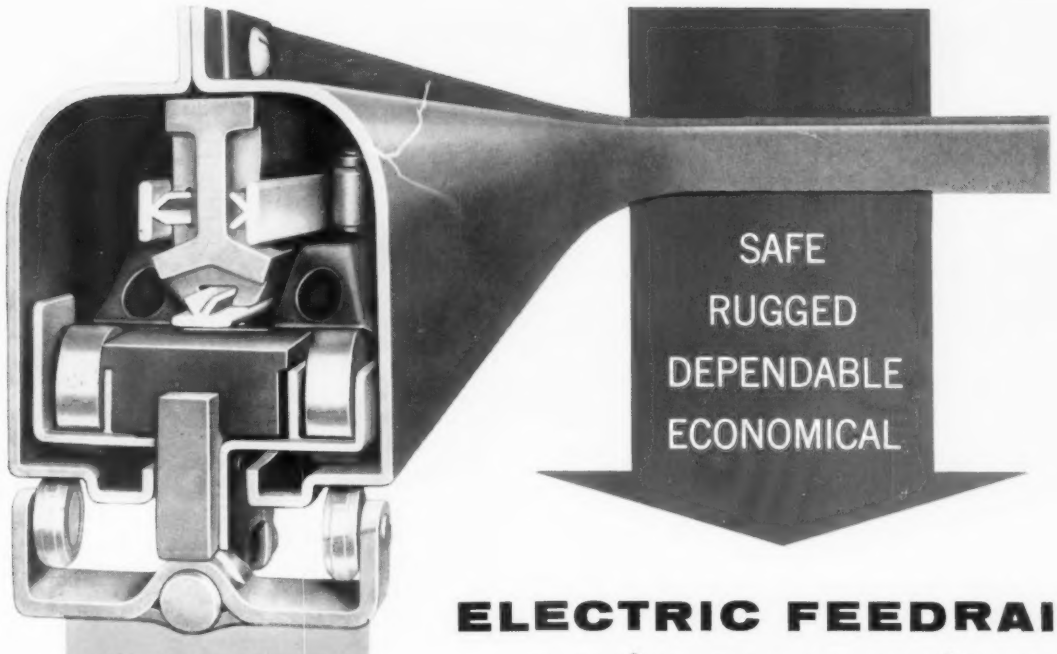
352 SHAW ROAD
SOUTH SAN FRANCISCO, CALIF.

PLANTS ALSO IN LOS ANGELES; PORTLAND, OREGON; AND VANCOUVER, B. C., CANADA

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY



SAFE
RUGGED
DEPENDABLE
ECONOMICAL

ELECTRIC FEEDRAIL®

moving power systems

go where the "loads" go!

A FEEDRAIL "moving power system" lets you deliver power where you want . . . when you want it. Designed to *go where the loads go*, FEEDRAIL feeds power through smooth-riding, engineered trolleys to provide outlets *anywhere* along the line.

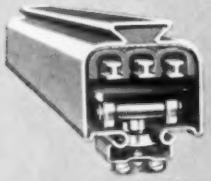
Since 1935, FEEDRAIL has proved the safest, most dependable way to distribute power to mobile equipment. Basic designs remain unchanged because no other systems offer comparable safety and dependability. And here's why:

1. Steel enclosed design eliminates accidents –
2. Unfailing reliability prevents costly service interruptions due to wiring failure –
3. Heavy-duty construction withstands hard usage, keeps maintenance costs down.

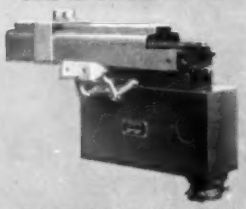
INSTALLATION NO PROBLEM: Track sections are prefabricated of heavy guage steel in practical lengths. Precisely constructed for fast installation, FEEDRAIL offers no problems – even where curves are involved. And FEEDRAIL can be readily extended, modified or relocated.

INFORMATION FOR YOU: Your local Graybar salesman can show you how easily the right FEEDRAIL system can be installed in your plant. See him for details or write Feedrail – Dept. C-4.

FEEDRAIL "100" – For cranes and hoists, portable tools, production and test lines, machine tools, airport hanger doors. Continuous current rating – 100 amperes. Send for Bulletin No. 50.



FEEDRAIL "60" – For light hoists, cranes, small portable tools, lighting, business machines, cutting and sewing equipment. Continuous rating – 60 amperes. Send for Bulletin No. 45.



FEEDRAIL "HEAVY DUTY" For heavy duty cranes and hoists, large machine tools, conveyor assembly lines. Continuous current ratings – 225, 375 and 500 amperes. Send for Bulletin No. 35.

Never Becomes Obsolete

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N. Y.

ELECTRIC FEEDRAIL®

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

To spot what's NEW and best for you

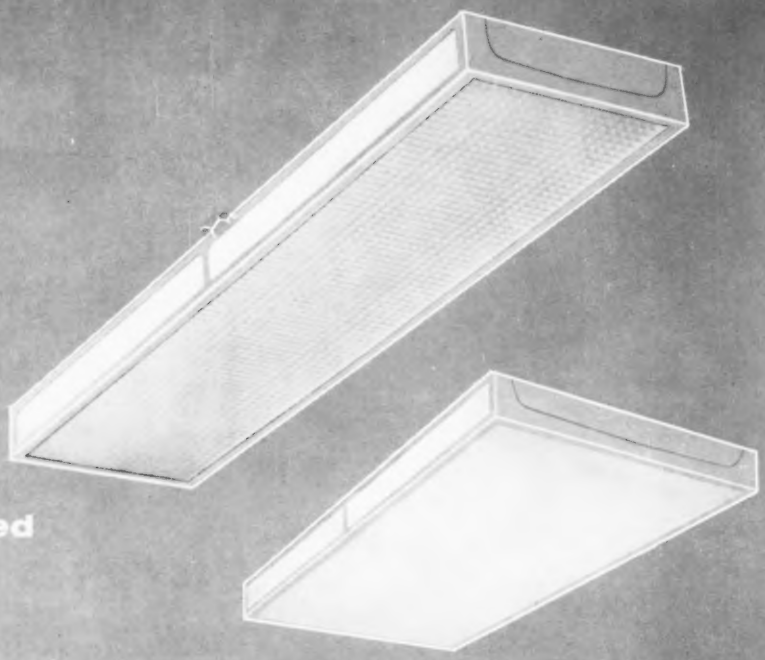
call GraybaR first for...

Everything Electrical GraybaR

Introducing GARCY Lighting's

60th ANNIVERSARY SERIES

New Surface-Mounted Fixtures

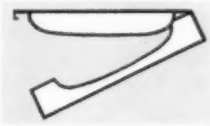


- 2 or 4 lamp units, only 3½" deep
- Hinged one-piece enclosures
- Regular or translucent sides
- For 48" rapid start lamps

Especially suitable for modern low ceilings, the 60th Anniversary Series embodies simplicity in design, glare-free visual comfort and efficient light utilization. This versatile series offers unique advantages to cost-conscious contractors.

ONLY TWO BASIC PARTS TO INSTALL

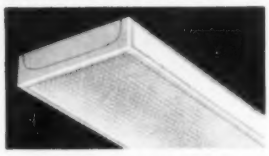
1. Compact Chassis
2. One-Piece Enclosure



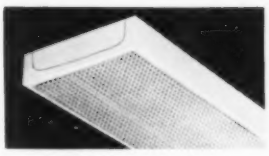
The lightweight chassis is easy to handle. Hinged enclosure is furnished ready for installation . . . no small parts to assemble.

Your Choice of these Distinctive Treatments

ALBA-LITE GLASS

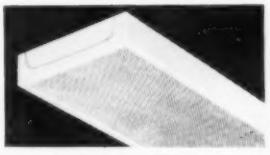


ONE-PIECE PLASTIC LOUVER



EXTRULITE CLEAR PLASTIC

FLAT PLEXIGLAS PANEL



LOW BRIGHTNESS LENS

DISHED PLASTIC

TRANSLUCENT SIDES

REGULAR SIDES

GARCY

Garden City Plating and Manufacturing Company
2475 Elston Avenue • Chicago 47, Illinois

In New York City—48 West 48th Street
In Los Angeles—Garcy Western Corporation, 3912 Broadway Place
In Canada:—Garcy of Canada, Ltd., 1244 Dufferin Street, Toronto

To spot what's NEW and best for you
call GraybaR first for . . .
Everything Electrical GraybaR

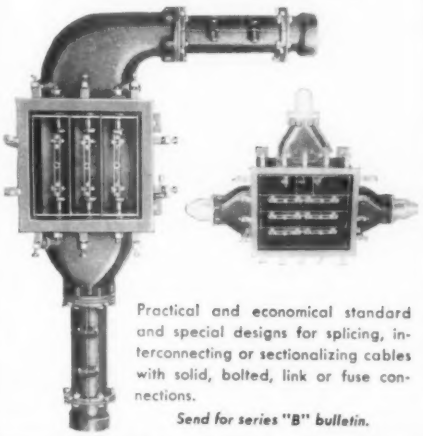
G&W POTHEADS

A TYPE AND SIZE OF PROVED DESIGN FOR EVERY HIGH VOLTAGE CABLE.

Sodertite, Capnut, Disconnecting—Solder, Clamp or Press style connectors for copper conductors, Press style for ALUMINUM conductors—Wiping sleeve or stuffing box cable entrance seals—Conduit and armor fittings—The G&W line of potheads is complete.

Send for series "A" bulletins

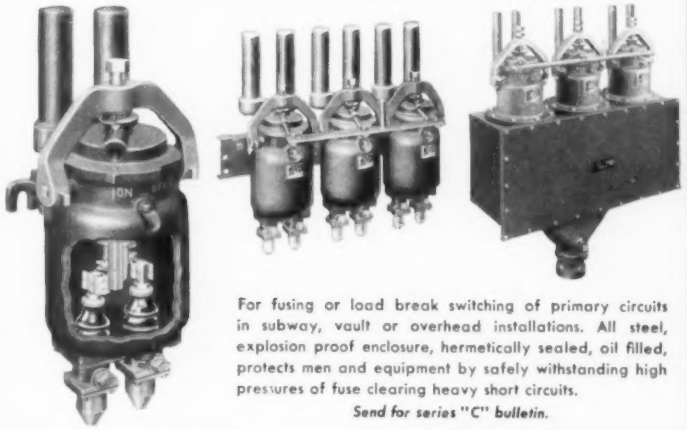
G&W BOXES



Practical and economical standard and special designs for splicing, interconnecting or sectionalizing cables with solid, bolted, link or fuse connections.

Send for series "B" bulletin.

G&W OIL FUSE CUTOUTS



For fusing or load break switching of primary circuits in subway, vault or overhead installations. All steel, explosion proof enclosure, hermetically sealed, oil filled, protects men and equipment by safely withstanding high pressures of fuse clearing heavy short circuits.

Send for series "C" bulletin.

G&W LOAD BREAK OIL SWITCHES

PROVIDE CABLE SYSTEM FLEXIBILITY

Reduce overtime work on system maintenance. Sectionalize your distribution system with Type "RA" load break oil switches. Isolate cable faults and restore service by switching loop or duplicate feeders—manually or automatically.

Send for series "D" bulletins.

G&W SPLICING KITS

SAVE TIME AND MONEY

- Each item supplied in the correct quantity for a properly designed joint.
- Time and expense of securing various items from different sources are saved.
- Accumulation of dead stock is avoided. No waste.
- All materials are kept clean and ready for use.
- Each Splicing Kit is labeled for easy identification.
- Cable splicing costs can be determined accurately.

Send for series "J" bulletins.

Complete catalog including separate bulletins on various cable devices will be sent on request

G&W ELECTRIC SPECIALTY CO.

3500 W. 127th Street, BLUE ISLAND, ILL. G571

Representatives in many cities of N. and S. America Canadian Mfr. Powerlite Devices, Ltd., Toronto, Montreal and Vancouver

Quality cable devices since 1905

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

NOW···GLOBE OFFERS···
two new INTERCHANGEABLE trays for support of cables, wiring and tubing

★ Engineered for uniform design and easy installation
★ Steel or aluminum construction
★ Complete accessories for SPEEDIER Installation
★ No sharp edges to damage cables
★ Complete interchangeability

Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

Distributors are to be found in all principal cities—consult the yellow pages in your phone book under "Gratings" or "Conduits" for the one nearest you.

100

PRODUCTS DIVISION

The **GLOBE** *Company* MANUFACTURERS SINCE 1914

4032 SOUTH PRINCETON AVENUE, CHICAGO 9, ILLINOIS

To spot what's NEW and best for you

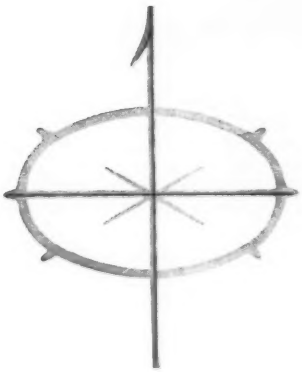
call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

GENERAL CABLE

the largest independent manufacturer of electrical

WIRES and CABLES



QUALITY PRODUCTS to cover every wire and cable requirement.

- BARE AND WEATHERPROOF
- BUILDING WIRES AND CABLES
  Rubber and Thermoplastic
- PORTABLE CORDS AND CABLES
- SERVICE CABLES
- POWER AND CONTROL CABLES
  Rubber and Thermoplastic
  Asbestos
  Varnished Cloth
- SAFETY MINERAL INSULATED WIRING SYSTEMS

for quality and service... **specify GENERAL CABLE**

GENERAL CABLE CORPORATION, 420 Lexington Avenue, New York 17, N.Y.

To spot what's NEW and best for you

call GraybaR first for...

TOOLS FOR CRAFTSMEN

LET GREENLEE TOOLS

CUT COSTS ON YOUR CONDUIT INSTALLATIONS

GREENLEE
No. 880
Hydraulic Bender

one-stroke 90° bends in 4" conduit...4 minutes!

Bend ten sizes of conduit up to 4 in. as much as 90° with one fast ram stroke in the GREENLEE No. 884 Hydraulic Bender. High-strength steel and aluminum construction, plus advanced features, make it easy for one man to wheel this big bender from job to job, set it up quickly, and operate it efficiently. 90° bend in 4-in. conduit takes four minutes operating with GREENLEE No. 798 Power Pump (shown) — only 30 seconds with GREENLEE No. 797 Power Pump! Accurate bends of all degrees in all conduit sizes produced at proportionate speeds. Rapidly pays for itself and nets substantial time and materials savings on cost of job after job.

90° bends in conduit up to 2 in. in one fast ram stroke with the lightweight GREENLEE No. 880 Hydraulic Bender. Easily carried by one man. Fast setup and operation. Use with hydraulic hand pump or power pump. Attachments for bending thin-wall conduit, tubing, and bus-bar. Quickly pays for itself.

Exclusive two-speed GREENLEE Power Pumps feature extra-fast ram approach, minimize costly waiting time. Automatic change-over to high-power drive. Operate benders three to five times faster than hand pump. Easily carried by one man.

Three ways to cut the cost of cutting conduit openings

GREENLEE Knockout Punches save time and work — operate easily with an ordinary wrench. Make clean, accurate conduit openings on the job . . . no filing or reaming. Openings for ½-in. to 5-in. conduit in metal up to 10 gauge in 1½ minutes or less! Slugs fall loose in die — just tip them out. Ask your distributor about handy sets and individual punches.

New ball-bearing drives for knockout punches reduce friction, speed knockout punch operation, cut to a minimum the "muscle power" needed to operate GREENLEE Knockout Punches by hand.

Available for all size punches ½ in. to 5 in. Order for present punches or with new knockout punches you buy.

Hydraulic driver enlarges knockouts in seconds! Just a few easy strokes on the handle of the GREENLEE No. 7646A Hydraulic Knockout Punch Driver, and the punch slices cleanly through 10-gauge metal! Small, handy driver operates all GREENLEE Knockout Punches ½ in. to 5 in. — available separately or in any of three convenient kits including knockout punches.

GREENLEE Cable Puller

— simple, compact unit exerts up to 7,500-lb maximum pull. Two speeds. Clamping device fastens to conduit — allows pulling in line with conduit, prevents hanger loosening. Attachment for concealed conduit.

GREENLEE Electricians' Power Bits and Extensions

— GREENLEE quality is your assurance of more fast, smooth openings with every bit. GREENLEE Power Bit sizes now range up to 40/16 in.

SEE YOUR ELECTRICAL DISTRIBUTOR, or write for complete information.
GREENLEE TOOL CO., 1744 COLUMBIA AVE., ROCKFORD, ILLINOIS

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

FOR HUNDREDS OF

STANDARD

SIZES

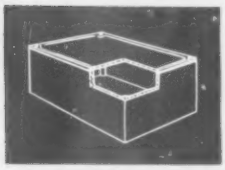
...PLUS COUNTLESS

CUSTOM

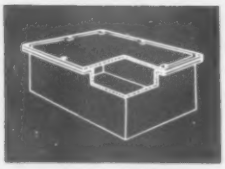
VARIATIONS

...CAST BOXES* BY HOPE

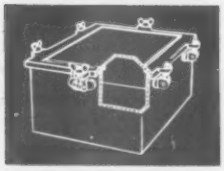
STANDARD TYPES & SIZES



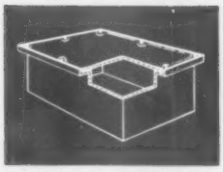
UNFLANGED BOXES
H1200 Type
164 sizes
from 4 x 2 x 2 to 48 x 36 x 17



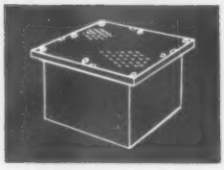
FLAT FLANGED BOXES
H8000 Type
87 sizes
from 4 x 4 x 3 to 36 x 36 x 12



HINGED COVER BOXES
H3200 Type
128 sizes
from 5 x 5 x 3 to 36 x 36 x 12



FLANGED RECESSED COVER BOXES
H7000 Type
51 sizes
from 4 x 4 x 3 to 30 x 24 x 12



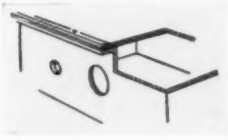
CHECKERED COVER SIDEWALK BOXES
H5800 Type
53 sizes
from 6 x 6 x 4 to 36 x 24 x 14

STANDARD BOXES are of strong, dense cast iron—hot dip galvanized for long service and attractive appearance. Weatherproof construction—rubber-gasketed closure prevents entry of rain, snow, sleet or dust under normal conditions.

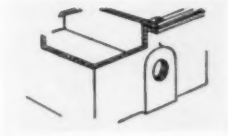
CUSTOM VARIATIONS

You can specify any of these modifications in standard BOXES by HOPE —have them factory-made at moderate cost—and get prompt delivery.

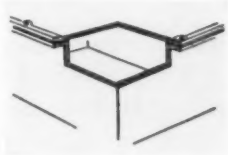
DRILLING—
or drilling and tapping—
of conduit entrances



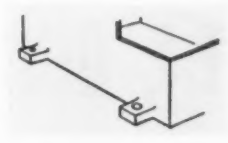
BOSSES—
to provide extra thickness
for five-thread conduit entrances.
Drilled and tapped to specification
if desired



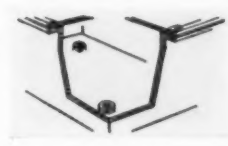
SPECIAL GASKETS —
Neoprene for fungus resistance in hot, humid climates • pure gum for extreme softness and resistance to special acids • Vellumoid for resistance to oils and fats • graphite-free compressed asbestos for installation near boilers or steam pipes



MOUNTING LUGS—
drilled for bolts



INTERIOR MOUNTING BUTTONS—
—tapped blind
to specified centers



AND . . . you can order these custom modifications, as well as standard BOXES by HOPE, conveniently and quickly, through your local electrical distributor.

• OUTLET BOXES AND FITTINGS • JUNCTION AND PULL BOXES • HINGED CABINETS • TERMINAL BOXES • EXPLOSION HOUSINGS

HOPE

ELECTRICAL PRODUCTS CO., INC.

61 Long Avenue, Hillside, N. J. Elizabeth 4-7837

EXPLOSION HOUSINGS BY HOPE

have been extensively used in Class 1, Groups C and D hazardous locations, such as chemical, petroleum and powder plants, pump rooms and paint plants.

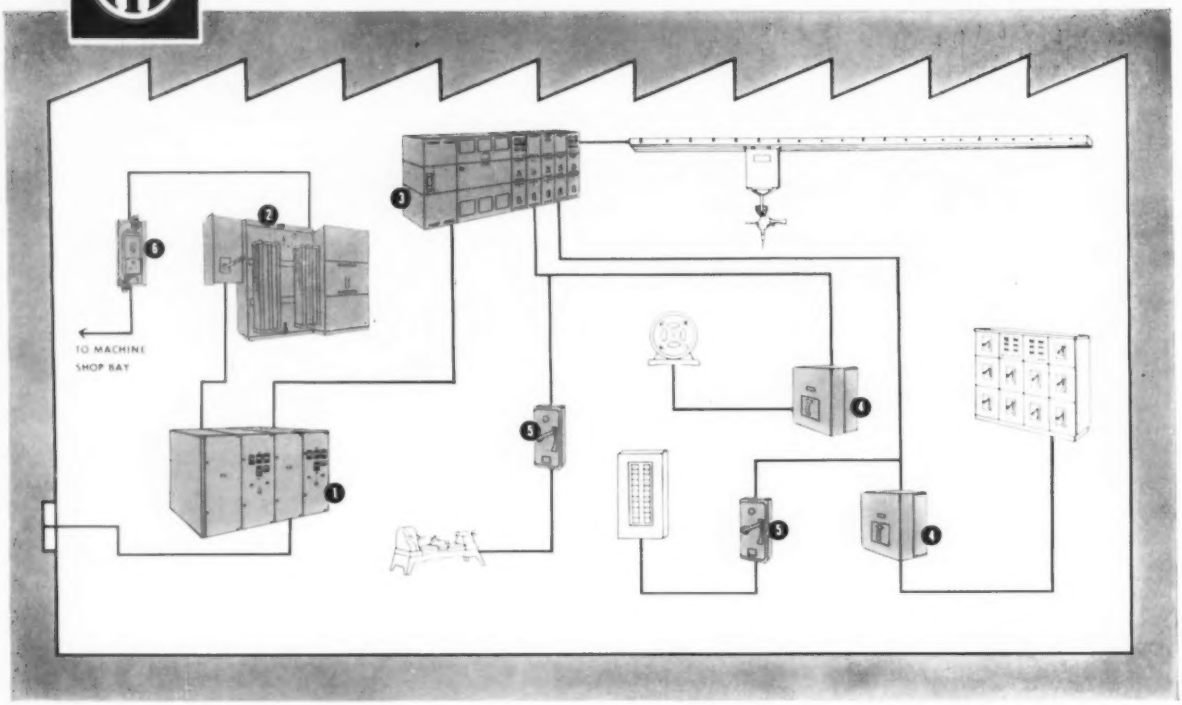
GET THE FULL STORY ON BOXES BY HOPE —
WRITE ON COMPANY LETTERHEAD FOR CATALOG

To spot what's NEW and best for you

call GraybaR first for...

GRAYBAR Everything Electrical GraybaR ELECTRIC COMPANY

IDEAS FOR GRAYBAR CUSTOMERS



❶ High voltage switchgear ❷ Packaged unit substation (Tranfo Unit) ❸ Secondary unit substation (including low voltage switchgear) ❹ Individually enclosed low voltage power circuit breaker ❺ Individually enclosed molded case circuit breaker ❻ Individually enclosed current limiting circuit breaker (CORDON®)

I-T-E QUALITY STRETCHES YOUR DOLLARS

A broad equipment line with extra value at no extra cost

Start where electricity comes into a plant or building. Travel all along the distribution lines to where it is used. The chart above gives you an idea of how many places I-T-E electrical equipment can work for you —conducting, channeling, protecting electric power. And everywhere its superior design and construction insure more dependable performance. For complete information, see your I-T-E distributor.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA

To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical GraybaR Electric Company

IDEAL WIRING TOOLS...

a good way to cut costs thru faster better work by the Man-on-the Job!

Ideal Wiring Tools help your men do a better job faster. Contractors and electricians coast to coast consider Ideal tools "standard" equipment for ease of use and efficiency on the job.

Get exactly the tools you need—when you need them. It's fast and economical, just specify Ideal—one dependable source for everything in electricians tools. Shown here are just a few items from the complete Ideal line.

IDEAL VOLTAGE TESTER

"Easy Tester" 2-ways safe

This is a voltage tester that protects you two ways! It has both a neon test lamp and a calibrated solenoid indicator . . . each independent of the other. No chance of failure to detect voltage. Handy center mount for the prod keeps the indicator always in the line of vision. Case is of double strength seamless plastic, with no external metal. Molded prod handles have "No-Slip" safety rings, are mounted on 30" leads. Prods when not in use are completely shielded in case. Tests 110 to 550 volts AC—110 to 600 volts DC.

IDEAL FISH TAPE REEL and PULLER

The big grip that takes most of the work out of fishing. Actually lets you do the job in 50% of the time as compared to hand fishing . . . like an extra arm or bigger muscles. And they may save your life—because the tape is always in reel or conduit. It can't ever spring loose into "hot" wires or moving machinery. Also, no cuts, skinned fingers or lost time! 50 to 200-foot lengths — all tapes of finest oil tempered flat spring steel.

IDEAL FISH TAPE WINDER

"Fishing" made easy

Just roll it around our IDEAL Fish Tape Reel. Spreads the Reel housing, so that Tape reels in or out much more easily. Just rotate the handle. Double rollers hold the Winder in place. Three sizes fit all IDEAL Reels.

IDEAL WIRE LUBE

Less Work, Strain, and Danger of Insulation Breaks!

IDEAL Wire-Lube actually lubricates wires and cables just like the oil you use in your car to lubricate bearings. It lets you slide wires into or out of conduit easier, dries to a fine powder, is as gentle on your hands as a fine soap. It is non-combustible, non-corrosive. For use on rubber, lead or plastic covered wire or cable. Available in 1 quart cans to 5-gal. pails.

NEW Low Cost WIRE STRIPPER

Strips wires from 10-18 ga. cleanly, quickly, and easily. Also used for cutting and "looping" wires. A handy addition to every electrician's tool kit. Sturdy, compact-constructed of hardened steel for rugged duty and long service life. Contoured plastic grips for easy handling and safety. Overall size 6". Flat design for easy tool kit and pocket fit.

IDEAL "E-Z" STRIPPER

6 models including *UF cable stripper

Used more, liked more and sold more than any stripper we know of. Rugged, all-steel and as easy to use as pliers. They are so designed that they can't damage wire or crush stranded wire ends, because of their automatic lock. Replaceable blades are of hardened steel. Six models handle all wire gauges from No. 8 to No. 26, also 300 ohm TV down lead and most non-metallic sheathed cable. The stripper for heavy-duty work.

**"E-Z" UF cable stripper strips the outer sheath and web, then the inner conductors (2 or 3 wire, 12 or 14 ga.) from non-metallic sheathed cable—without cutting, nicking, or other damage to wire ends.*

IDEAL COMBINATION FUSE PULLER AND TEST-LITE

NEW

A new tool for maximum safety in pulling cartridge-type fuses and in checking electrical connections. Sure-grip dielectric plastic handles make fuse pulling faster. Positive testing is assured by built-in resistors which limit current flow through the tester. Test capacity from 100V. to 600V. AC or DC. Designed for use on fuses up to 100 amp., 250 volts and 60 amps., 600 volts.

IDEAL INDUSTRIES, Inc.
1041-D Park Avenue, Sycamore, Illinois

To spot what's NEW and best for you

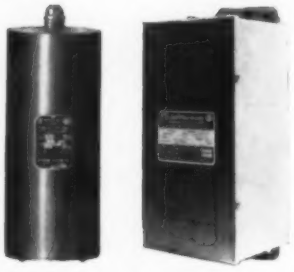
call GraybaR first for...

GraybaR Everything Electrical GraybaR

Jefferson

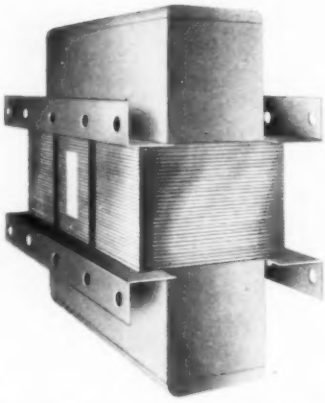
because dependability is so important to you

Skilled craftsmen, using the most modern equipment . . . producing the finest transformers and ballasts you'll find anywhere. Be sure—always specify Jefferson.



MERCURY LAMP BALLASTS—The *world's most complete* line of ballasts for street lighting, outdoor and indoor commercial and industrial mercury lamp installations . . . outdoor models include Jefferson's new moisture-proof Aqualift Sealant.

FLUORESCENT LAMP BALLASTS—Many design and manufacturing safeguards insure the low noise level of every model in this complete line.



POWER CIRCUIT TRANSFORMERS—Available in single phase and now 3-phase with low noise level for mounting at the point of load. There's a model to fit your needs.

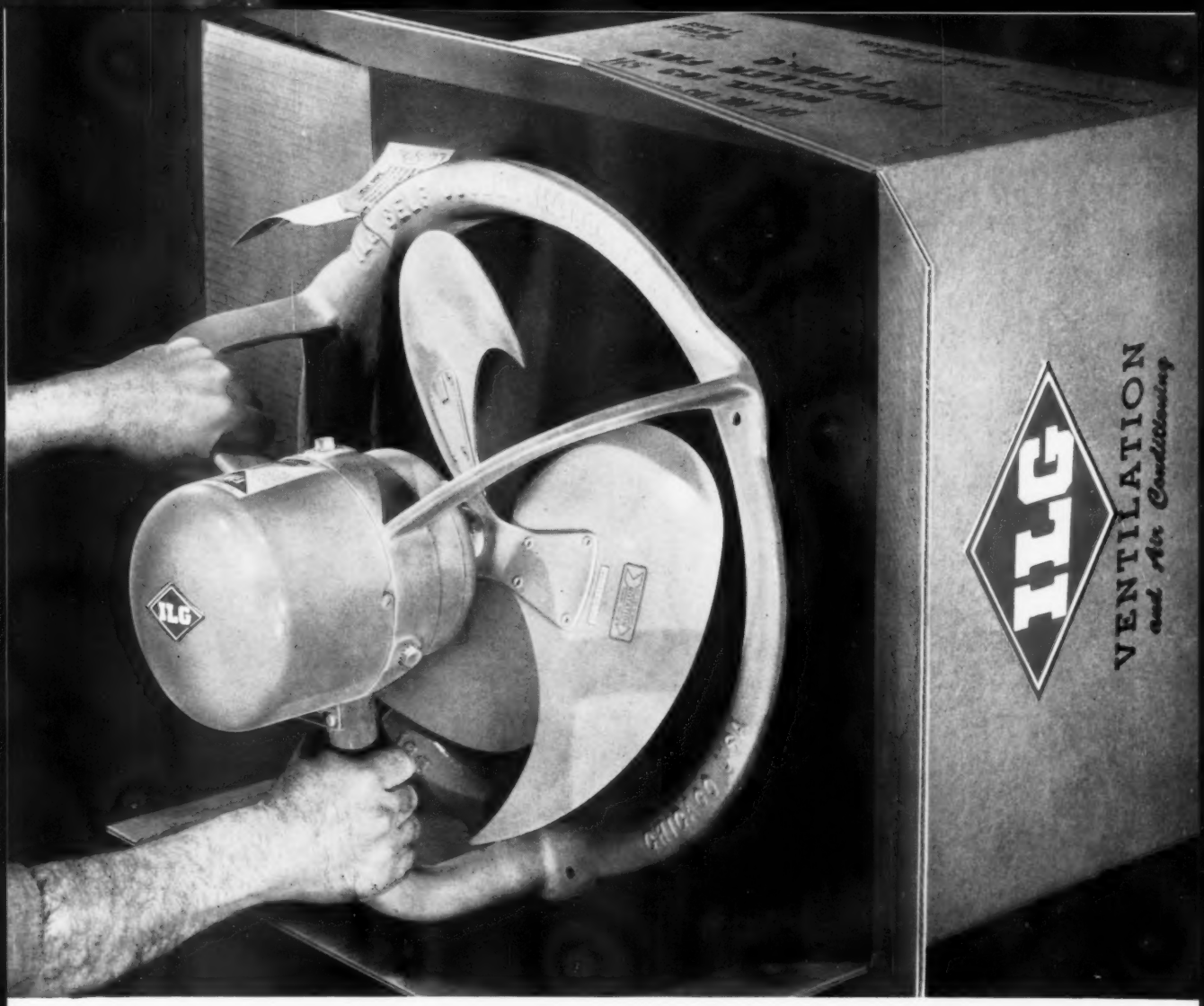
Jefferson ELECTRIC COMPANY

Bellwood, Illinois

To spot what's NEW and best for you

call GraybaR first for . . .

GRAYBAR Everything Electrical GraybaR ELECTRIC COMPANY



ILG self-cooled propeller fans– today's best ventilation package

You are on safe, sure ground when you install Ilg self-cooled motor propeller fans. You get the protection of a fully enclosed motor and the low operating cost of an open motor. Dynamically balanced fan wheel, direct-connected to motor for lifetime alignment, assures smooth, quiet, free-running operation. Rated and certified under standard testing codes, Ilg fans can be relied upon to move more air, give you longer trouble-free performance.

Big selection, too. You can choose an Ilg fan from a complete range of sizes, 6″ to 72″. And you'll like the fast delivery from your nearest Ilg distributor, where Ilg stocks are carried and expert electric ventilating engineering service is at your command. For prompt help on your ventilating problems, call your distributor or write:

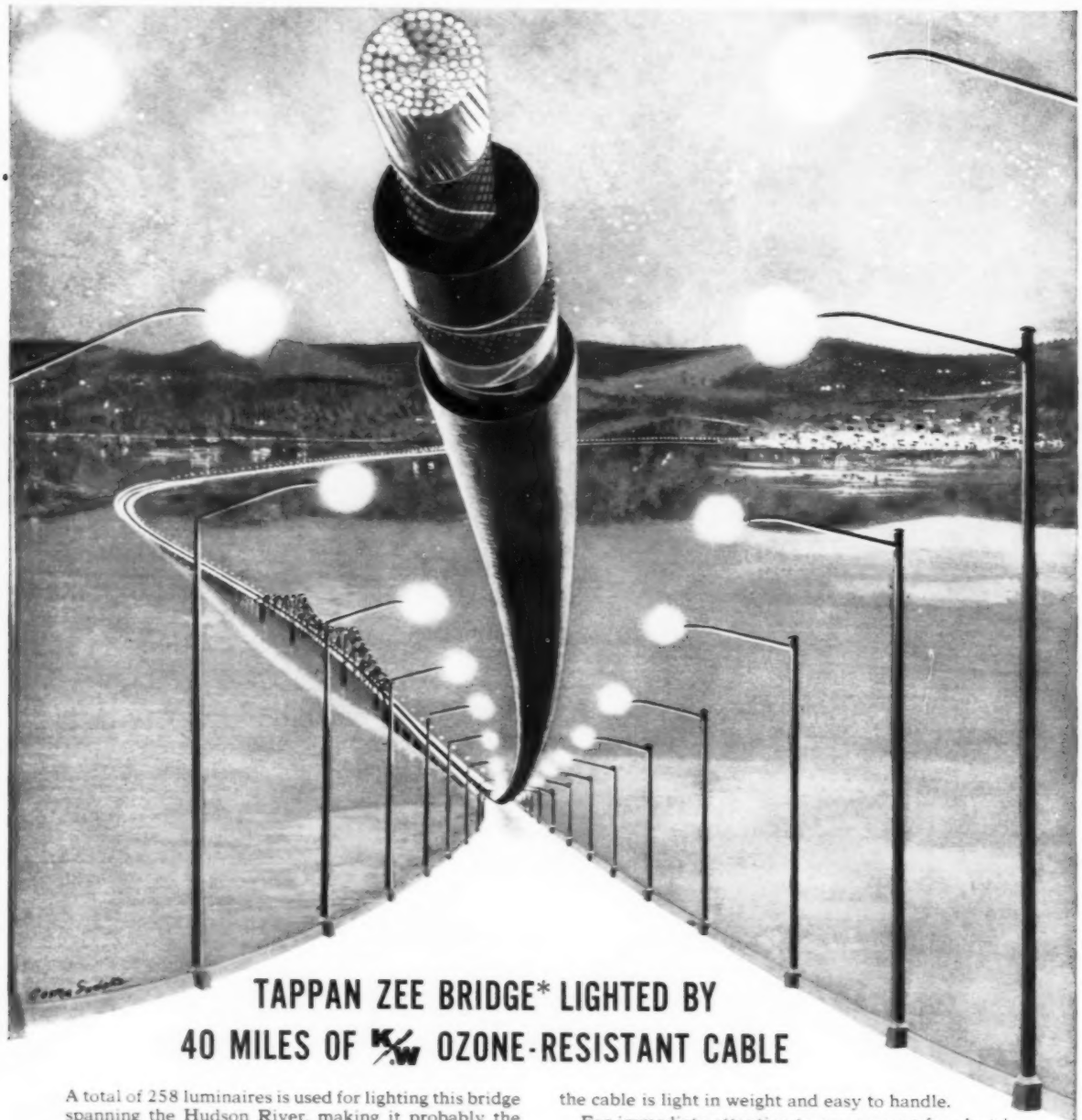
ASK FOR THIS FREE CATALOG

36-page Catalog No. 153 gives you full facts on complete line of Ilg Electric Ventilating Fans.

ILG ELECTRIC VENTILATING CO.
2879 N. Pulaski Road • Chicago 41, Illinois

To spot what's NEW and best for you
call GraybaR first for...
Everything Electrical
GraybaR

KW STREET LIGHTING CABLE



TAPPAN ZEE BRIDGE* LIGHTED BY 40 MILES OF KW OZONE-RESISTANT CABLE

A total of 258 luminaires is used for lighting this bridge spanning the Hudson River, making it probably the best-lighted bridge in the world. To minimize distribution costs, constant current series circuits are used.

The 40 miles of cable used on this lighting system is *ozone-resistant* KW Series Street Lighting Cable, 2,butyl insulation, 7,500-volt shielded, Spec. #831. The neoprene jacket provides the greatest protection against weather, acids, oils and all-around abuse. Yet the cable is light in weight and easy to handle.

For immediate attention to any request for electrical conductor products, engineering and research service, or further information, contact your nearest Kaiser Aluminum sales office or the KW distributor listed in your telephone directory.

Kaiser Aluminum & Chemical Sales, Inc., *Executive Office*, Kaiser Bldg., Oakland 12, California; *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois.

*Part of New York State Thruway System

"IF IT CARRIES CURRENT, KW CARRIES IT!"

KAISER ALUMINUM

SEE "MAVERICK" • SUNDAY EVENINGS, ABC-TV NETWORK • CONSULT YOUR LOCAL TV LISTING.

To spot what's NEW and best for you

call GraybaR first for . . .

GRAYBAR Everything Electrical GraybaR

Twist-Lock

A twist of the cap and it locks!

REGULAR

7311
3-wire Armored Cap

20 amps., 250 V. A.C. or D.C.
10 amps., 600 V. A.C.

7313
3-wire Connector Body

"INSULPRENE"

9770
2-wire Cap

20 amps., 250 V. A.C. or D.C.

Resistant to oil, water or impact

9768
2-wire Connector Body

GROUNDING

4700
Duplex Receptacle

15 amps., 125 volts

For grounding purposes only

4720
3-wire Rubber Cap

SUPER

3221
2-wire Armored Cap

20 amps., 250 volts

Screwless terminals and dead front

3223
2-wire Connector Body

30 AMP. SUPER

3331
3-wire Armored Cap

30 amps., 250 V. A.C. or D.C.

3333
3-wire Connector Body

MIDGET

7464
2-wire Connector Body

7465
2-wire Cap

10 amps., 250 volts
15 amps., 125 volts

7466
2-wire Male Flush Base

Hubbellock

Heavy-duty, dust-tight, locking connectors

30 amps., 600 V. A.C.
20 amps., 250 V. D.C.

20403
4-wire Receptacle with 20416 lift cover plate

20415
4-wire Male Cap

30 amps., 600 V. A.C.
20 amps., 250 V. D.C.

20414
4-wire Connector Body

HUBBELL

It Pays To Have Good Connections

For over 70 years, Hubbell specification grade wiring devices have been recognized for their dependability, trouble-free operation and quality appearance. And there are other reasons, too, why it is good business to specify Hubbell. For example:

Hubbell devices incorporate carefully engineered installation advantages which save you time, trouble and expense.

Hubbell devices are always readily available—sold exclusively through authorized electrical distributors who are supplied from strategically located warehouses throughout the country.

Hubbell devices are nationally advertised and merchandised to support your selling efforts.

Hubbell devices are backed by field engineering to assist you in any phase of your electrical installation.

The products shown are representative of Hubbell's complete line of quality wiring devices. For full information, write Harvey Hubbell, Inc., Bridgeport, Conn., or contact your local Graybar distributor.

GROUNDING DEVICES

5262
Duplex Receptacle

15 amps., 125 volts

For grounding portable elec. equip.

5264
Armored Cap

5661
Single Receptacle

15 amps., 250 volts

5676
Rubber Cap

A.C. SWITCHES

Withstand Inductive Fluorescent Loads

15 amps. 120-277 volts

Topper 1201
Single Pole A.C. Toggle Switch

15 amps. 120-277 volts

pressSwitch 1251-1
Single Pole press-action A.C. Switch

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

Another Lighting Installation that Speaks for Itself and says Volumes – by Litecontrol

Only a few short years ago, no amount of money could buy quality lighting such as you see above.

The photo shows a very practical way of illuminating a large banking area graciously and *inexpensively* — with LITECONTROL standard fixtures.

We believe the excellence of the pattern arrangement speaks for itself — both in its eye appealing qualities and in the provision for more light in the work areas than in the public area. The Holophane acrylic lenses are almost two feet square and extremely efficient and *low in brightness*.

Cleaning and servicing the fixtures is very easy. Finger-tip pressure on triggers opens fixture doors easily. Doors are closed just as easily by simply pushing them back in place.

Remember . . . even with lighting budgets tighter, you can get lighting that's better — with LITECONTROL.

INSTALLATION:
Hartford National Bank & Trust Company
Middletown Branch, Middletown, Conn.
ARCHITECT:
Jeter & Cook, Hartford, Conn.
ENGINEER:
Walter Heywood of Henri VanZelm Associates
West Hartford, Conn.
ELECTRICAL CONTRACTOR:
Julio Guiffrida, Middletown, Conn.
FIXTURES:
Litecontrol No. 8344 4 lamp recessed 2' x 4' fixtures, using Holophane 6025 acrylic PRISMALUME* lenses and 40 watt Standard Cool White Rapid Start Lamps
CEILING HEIGHT:
18' — 0"
INTENSITY:
Average on desk tops in work areas, 100 foot-candles in service
*Reg. Holophane Co., Inc.

LITECONTROL

Fixtures

KEEP UPKEEP DOWN

LITECONTROL CORPORATION,

36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

For the fastest, easiest, most accurate way to bend rigid or thinwall conduit

NO. 1 AND NO. 1T

YOU CAN BEND ½"—¾" and 1" CONDUIT EASILY WITHOUT CHANGING PARTS

These are complete machines of all steel construction. No loose parts that can be misplaced or lost. The "Chicago" bender gives you perfect, smooth, uniform bends every time. It's simple to make repeat bends because our exclusive calibrated degree scale (shown in circle) eliminates guesswork as to accuracy. Even 180° bends are simple and easy to make. When using a "Chicago" bender you always turn out professional work quickly without special skill. The accurate bending sector does the work and supports the full length of bend. Its low maintenance and light weight (66 lbs.) make it a real on-the-job tool. When ordering without stand for truck or post mounting, clamp bars can be furnished.

BENDING CIRCLES: INSIDE RADIUS:

	No. 1	No. 1T
½" CONDUIT OR PIPE	2"	EMT 3"
¾" CONDUIT OR PIPE	4¼"	EMT 8½
1" CONDUIT OR PIPE	5¾"	EMT 13"

NO. 2 AND NO. 2T

FOR HEAVY DUTY CONDUIT . . . BENDS 1¼" and 1½" PIPE WITH EASE

This is also a complete machine of all steel construction incorporating a simple but extremely powerful toggle-ratchet mechanism which has been field proven for many years and requires no maintenance other than an occasional drop of oil. It's designed for real outdoor work. By using extension plugs, the No. 2 like the No. 1 will produce conduit ells at a considerable saving. Smooth offset are easy and fast to make. These machines will operate in any position where conditions make it easier to move the machine . . . yet the rugged stand gives solid support at a comfortable working height. The same type of degree scale (shown in circle above) reads actual bend directly and makes repeats easy. Stands have built-in square and scale for checking bends.

BENDING CIRCLES: INSIDE RADIUS:

	No. 2	No. 2T
1¼" CONDUIT OR PIPE	7¼"	EMT 9½"
1½" CONDUIT OR PIPE	8¾"	EMT 10½"

EXCLUSIVE . . . CALIBRATED DEGREE SCALE ON ALL MODELS GIVE YOU ACCURATE REPEAT BENDS

1. Stand
2. Back plate
3. Carriage bolt
4. Pawl release
5. Handle
7. Sector
9. Jaw
10. Degree scale
12. Square

For full details get your copy of Bulletin No. 556.....

LIDSEEN OF NORTH CAROLINA, INC.
1000 FIRST STREET • HAYESVILLE, NORTH CAROLINA

To spot what's NEW and best for you

call GraybaR first for . . .

Everything Electrical GraybaR

BUILT TO LAST

THE LIFE OF THE EQUIPMENT IT SERVES

MERCOID SERIES "D"

PRESSURE — TEMPERATURE CONTROLS

PLUS

These approvals and listings

GENERAL PURPOSE

NEMA 1. For indoor service and other general purpose applications where atmospheric conditions are normal. This type of construction serves as a protection against dust, and light indirect splashing.

U/L Types, DA, DR, DS,
CSA.

WEATHER RESISTANT

NEMA 1A, 2, 3, 4: For outdoor service and other applications. This type of construction is semi-dust tight; drip tight; weather resistant (weather proof, splash proof, sleet proof, moisture resistant, rain tight) water tight (hose test).

U/L
CSA Type DAW
FM

EXPLOSION PROOF

Class 1 Group C and D (NEMA 7): Atmospheres containing gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvents, vapors and natural gas. Class 2 Group E, F, and G (NEMA 9, 9A): For atmospheres containing metal dust, carbon black, coal or coke dust and grain dust.

U/L Types DAE, DRE,
CSA

Bourdon Tube Power Element—Outside Adjustments (No Tools Required)—Visible Settings Over Calibrated Dial—Visible "On-Off" Sealed Mercury Contact—A Wide Selection Of Operating Ranges With Varying Differentials.

WRITE FOR CATALOG NO. 858

Our engineers are at your service

THE MERCOID CORPORATION, 4201 BELMONT AVE. CHICAGO 41, ILL.
205 E. 42nd St., New York · 3137 N. Broad St. Philadelphia

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

There's an EVEREADY BRAND Flashlight and Battery

Tailored for every industrial job—right here...

Standard Flashlight Types

NO. 5MF. MAGNET LITE

Magnet holds fast to any iron or steel surface.

NO. 320. "BEACON" LITE

Jumbo light . . . heavy-duty features . . . terrific value.

No. 8251. END-LOADER AUTOMATIC SPOTLIGHT

All-chrome finish. Removable bottom cap. Ring-hanger.

No. 220. LARGE PENLITE

Heavy-duty type with all-chrome finish . . . pocket clip.

TWO-CELL HEAVY-DUTY SPOTLIGHT

No. 1251A — Rugged insulated case (ethyl cellulose) *will not* shatter, crack or dent. Withstands deterioration from water, oils, greases, gasoline, alcohols and acids. Unbreakable safety-glow lens-guard. Also available in three-cell size . . . No. 1351A.

TWO-CELL SAFETY SPOTLIGHT

No. 1259A — Same as 1251A with extra safety features; extra lamp in bottom cap. Approved by U. S. Bureau of Mines and listed by Underwriters Laboratories, Inc. Also available in three-cell size . . . No. 1359A.

"EVEREADY" No. 950 BATTERY

Gives ideal balance of long shelf-life and service-life for all applications, except extreme heavy-duty uses where "Eveready" No. 1050 is recommended.

"EVEREADY" No. 1050 INDUSTRIAL FLASHLIGHT BATTERY

Delivers twice the usable white light of any previous "Eveready" flashlight battery. Engineered for heavy-duty use.

"EVEREADY" "IGNITOR" DRY CELL No. 6

Outstanding recuperative power . . . ideal for ignition, radio, bells, buzzers, electric games, toys, lanterns, etc.

"EVEREADY" No. 409 LANTERN BATTERY

Dependable, long-lasting . . . fits railroad and most popular industrial types of hand lanterns.

"EVEREADY" No. D-99 HEAVY-DUTY FLASHLIGHT BATTERY

New inside-out design for plus power, longer life, dependability for day-in, day-out heavy duty use.

"EVEREADY" No. 735 GENERAL PURPOSE BATTERY

Specially designed for general ignition, telephone, portable instruments, electronic equipment, etc.

The terms "Eveready", "Ignitor", "Nine Lives" with the Cat Symbol, and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

NATIONAL CARBON COMPANY

Division of Union Carbide Corporation

30 East 42nd Street, New York 17, N. Y.

Sales Offices: Atlanta, Chicago, Dallas, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco.

IN CANADA: Union Carbide Canada Limited, Toronto

UNION CARBIDE

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

Machlett Electron Tubes for Broadcasting & Industry

MODULATOR — OSCILLATOR — AMPLIFIER TRIODES

TYPE	CATHODE VOLTS	CATHODE AMPS	A.F. MU	MAXIMUM ANODE RATING VOLTS	AMPS	INPUT WATTS	DISS. WATTS	FULL INPUT FREQ. MCS.	COOLING
ML-2C39A	6.3	1.0	100	1000	0.125‡	125	100	2500	F-A
ML-212E	14.0	6.0	16	3000	.350	—	275	1.5	C
ML-220C	21.5	41.0	40	15000	1.5	—	10000	4	W
ML-220CA	21.5	41.0	40	15000	1.5	—	5000	4	F-A
ML-228A	21.5	41.0	16	6000	1.5	—	5000	3	W
ML-232B	20.0	60.0	40	20000	3.0	—	25000	3	W
ML-240B	21.5	41.0	40	12000	1.7	—	10000	20	W
ML-241B	14.0	6.0	16	3000	.350	—	275	7.5	C
ML-279A	10.0	21.0	10	3000	.800	—	1200	20	C
ML-298A	27	225	32	20000	11.0	—	100000	4	W
ML-298B	27	225	57.5	20000	11.0	—	100000	4	W
ML-342A	20.0	67	40	20000	2.5	—	25000	4	W
ML-343A	21.5	57.5	40	18000	2.0	—	10000	4	W
ML-343AA	21.5	57.5	40	18000	1.5	—	5000	4	F-A
ML-354	12.0	220	25	15000	12	150000	75000	20	W
ML-356	7.5	170	20	12500	6.0	60000	22500	25	W
ML-357B	10.0	10	30	4000	0.5	1800	400	100	C
ML-379A	10.0	21.0	10	3000	.800	—	1200	20	C
ML-381	6.0	1.0	100	3500	0.01*	35*	35*	3000	F-A
ML-880	12.6	315	20	10500	6.0	60000	20000	25	W
ML-889A	11.0	120	21	8500	2.0	16000	5000	50	W
ML-889RA	11.0	120	21	8500	2.0	16000	5000	40	F-A
ML-891	22.0	60	8.5	12000	2.0	18000	6000	1.6	W
ML-891R	22.0	60	8.5	10000	2.0	15000	4000	1.6	F-A
ML-892	22.0	60	50	15000	2.0	30000	10000	1.6	W
ML-892R	22.0	60	50	12500	2.0	18000	4000	1.6	F-A
ML-893A	20.0	183	34.5	20000	4.0	70000	20000	5	W
ML-893AR	20.0	183	34.5	20000	4.0	70000	20000	5	F-A
ML-5530	5.0	55	26	5000	1.75	8750	4000	110	F-A
ML-5531	6.3	92	24	10500	3.75	30000	10000	30	F-A
ML-5541	7.5	57	26	8500	2.75	23000	10000	110	F-A
ML-5604	11.0	176	19.5	12500	3.0	32500	10000	25	F-A
ML-5606	22.0	60	50	14000	2.0	25000	10000	1.6	W
ML-5619	11.0	176	19.5	12500	3.0	32500	20000	25	W
ML-5658	12.0	310	20	12500	5.0	60000	20000	15	W
ML-5666	11.0	120	21	10000	2.0	20000	12500	22.5	W
ML-5667	11.0	120	21	10000	2.0	20000	7500	22.5	F-A
ML-5668	22.0	60	50	14000	2.0	28000	20000	5	W
ML-5669	22.0	60	50	14000	2.0	28000	10000	5	F-A
ML-5681	12.0	220	25	15000	12.0	150000	75000	30	W
ML-5682	16.5	325	30	16000	20.0	300000	120000	30	W
ML-6256	12.6	27	21	5500	1.5	7000	5000	110	W
ML-6257	12.6	27	21	5500	1.5	7000	5000	110	W
ML-6258	12.6	27	21	5500	1.5	7000	3000	110	F-A
ML-6420	7.0	85	20	10000	2.2	20000	12500	30	W
ML-6421	7.0	85	20	10000	2.2	20000	10000	30	F-A
ML-6422	7.0	85	90	12500	2.5	30000	20000	30	W
ML-6423	7.0	85	90	12500	2.5	30000	12500	30	F-A
ML-6424	7.0	120	20	12500	3.5	40000	20000	30	W
ML-6425	7.0	120	20	12500	3.5	40000	12500	30	F-A
ML-6426	8.0	200	20	12500	8.0	80000	40000	30	W
ML-6427	8.0	200	20	12500	7.0	80000	20000	30	F-A
ML-6576	7.5	170	5.5	12000	5.0	45000	22500	25	W

New TRIODES

ML-2C39WA	5.8	1.0	100	1000	.125‡	100	100	2500	F-A
ML-2C41	6.3	1.03	100	3500†	4.0†	35	35	3000	F-A
ML-5530-H	5.0	55	26	8500	1.75	10000	4000	30	F-A
ML-5736	6.0	60	22	5000	1.4	5000	2500	60	F-A
ML-6623	6.0	60	22	5000	1.4	5000	2500	30	F-A
ML-6696	13.0	205	20	16000	11	120000	60000	30	W
ML-6697	13.0	205	20	16000	11	120000	35000	30	F-A

HIGH VACUUM RECTIFIERS

TYPE	CATHODE VOLTS	CATHODE AMPS	ANODE RATINGS INV. PKV	ANODE RATINGS PEAK MA	INSULATION	COOLING
ML-102A	20	19.0	75	750	Air	C
ML-103	10	11.5	125	78	Oil	R-C
ML-108	13	12.5	140	200	Oil	R-C
ML-115	10	11.5	125	100	Air	C
ML-120	13	12.5	140	200	Air	C
ML-121	10	11.5	140	100	Oil	R-C
ML-141	5.5	6.5	125	750	Oil	C
ML-170	13	12.5	200	200	Air	C
ML-180	13	12.5	200	200	Oil	R-C
ML-199	12	23	110	10000	Air	C
ML-222A	21.5	41	25	5000	Air	W
ML-322	6.3	.95	8	600	Air	C
ML-5575/100	20	24	150	1000	Air	C
ML-5576/200	20	32	150	2500	Air	C

New HIGH VACUUM RECTIFIERS

ML-142	3.8	6.6	100	250	Oil	R-C
ML-148	5.7	6.6	150	1000	Oil	R-C
ML-6908	12	23	150	10000	Oil	R-C

New SWITCH AND MODULATOR TUBES

	CATHODE VOLTS	CATHODE AMPS	A.F. MU	MAXIMUM RATINGS PEAK ANODE VOLTS	PEAK CATHODE CURRENT AMPS	ANODE DISS. WATTS	COOLING
DP-1 (Tetrode)	6.3	12	950	125000§	2	150	C
ML-6544 (Shielded Grid Triode)	6.0	60	90	25000	75	1000	F-A

LEGEND:

C . . . Convection
R-C . . . Radiation-Convection
W . . . Water
F-A . . . Forced Air
A.F. . . . Amplification Factor
‡ . . . D-C Cathode Current
* . . . Duty Cycle: 0.0033
† . . . Duty Cycle: epy 3,500 volts
ib 4 amps
Pulse Length 3 usec max
Duty 0.0025 max
§ . . . Hold-Off Voltage

For complete technical data or prices write Machlett Laboratories, Inc., Springdale, Conn., or nearest Graybar Office.

MACHLETT LABORATORIES, INC., Springdale, Connecticut

MACHLETT

To spot what's NEW and best for you
call GraybaR first for . . .
GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

HERE'S *double* PROTECTION

NOW galvanized Sherarduct is coated with NEW

FORMULA MVC-1

the modified vinyl copolymer that provides the most effective barrier against corrosive agents of all kinds

National Electric has developed a new way to combat conduit corrosion. It is called Formula MVC-1, a new modified polyvinyl chloride resin coating that's available only from National Electric.

Here's what MVC-1 does to even further increase the protection against corrosion offered by the Sherardizing process of galvanizing.

RESISTANCE TO CORROSIVE ATTACKS—In accelerated salt spray, sulphuric acid and caustic tests conducted by the Pittsburgh Testing Laboratories, new Sherarduct with Formula MVC-1 coat outlasted all hot dipped and other high-grade coated and galvanized conduits tested.

RESISTANCE TO FLAKING—Formula MVC-1 makes a tight, uniform; adhesive coating that withstands bending without cracking or flaking.

TEMPERATURE RESISTANCE—Formula MVC-1 is extremely resistant to high and low ambient temperatures and will withstand the majority of all industrial temperature conditions.

NOW ADD THIS NEW CORROSION RESISTANCE TO SHERARDUCT'S OTHER FEATURES

1. The Sherardizing process of galvanizing that alloys zinc with the conduit walls.
2. Normalized, highly ductile steel for easy bending and threading.
3. Zinc protected threads for complete end-to-end protection.

These are the features that convince architects, engineers and contractors it is best to specify National Electric Sherarduct when real corrosion protection is required. Write for complete information on new Sherarduct today.

Listed by Underwriters' Laboratories, Inc.

Sherarduct with MVC-1 is Galvanized Conduit at Its Best

National Electric Products

PITTSBURGH, PA.

2 Plants • 12 Warehouses • 41 Sales Offices

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

Assure safe, "worry-free" splices by using tapes that are cable compounds . . .

in a safe, "worry-free" splice, the wall of electrical insulation around the connector is built up with a tape made with a cable insulation compound. The sheath, an extension of the cable's protective covering, is composed of a weather-, chemical- and abuse-resistant tape made with a cable sheathing compound. In other words, the splice . . . far from being a weak link in the cable . . . can be every bit as reliable.

Okonite splicing tapes are true cable compounds. The same ingredients are used in both. For example, Okolite Tape is made of the same basic compound as Okolite high voltage cable insulation. Okoprene Tape corresponds to the service-proved Okoprene cable sheath. Both of these materials — Okolite and Okoprene—have been specified by leading industrials for over 20 years.

Free samples of the Okonite Tapes are yours for the asking. Write to "Tape Dept., The Okonite Co., Passaic, N. J." and request a sample roll of whichever of the following you'd like: Manson Friction Tape, Okonite Low Voltage Insulating Tape, Okolite High Voltage Insulating Tape, Okoprene Sheathing Tape, or Okoweld All-purpose Tape.

YOUR COMMUNITY'S LEADING ELECTRICAL WHOLESALER IS THE AUTHORIZED DISTRIBUTOR OF OKONITE QUALITY TAPES.

where there's electrical power . . . there's **OKONITE CABLE**

5607

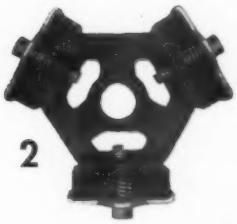
To spot what's NEW and best for you

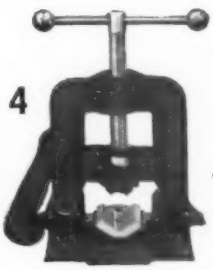
call GraybaR first for . . .

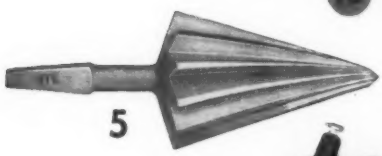
Everything Electrical GraybaR

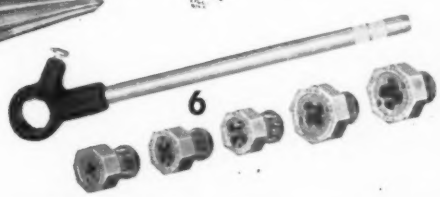
NYE Your BEST TOOL Buy!

Best because of the 50-years experience that's factory-built into every NYE tool to assure perfect operating efficiency on the job . . . And best because they're designed to perform ruggedly, dependably and economically always! You're bound to like a NYE tool.

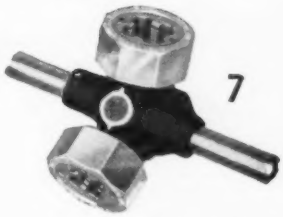


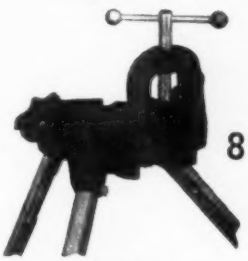






1. **NYE NO. 51B RATCHET PIPE THREADER**
   PAT. NO. 2629886. Cuts either Conduit or Pipe Threads. Opens automatically on both power and hand operation. Cannot jam. Can readily be changed for 1" thru 2" sizes . . . 300 times faster!
2. **NYE TRIPLEX SOLID DIE STOCK**
   For Conduit or Pipe Dies. Lightweight, ideal for threading machines. Openings in stock excellent for chip clearance and easy oiling.
3. **NYE TUBE CUTTERS WITH ROLLERS**
   Recommended for Copper, Alumin.um and other non-ferrous metals. ⅛"-1⅛" O.D. Also malleable Tube Cutters up to 2".
4. **NYE SELF-LOCKING VISES**
   Equipped with Long Jaws. Sizes ranging from ⅛"-4½".
5. **NYE BIT BRACE REAMER**
   Spiral Flutes with tapered shank to fit any standard bit brace.
6. **NYE TRIAD STOCKS**
   PAT. NO. 1752915. Can be furnished for Conduit or Pipe Threads ⅛"-¾" . . . ⅛"-1¼". Reversible for threading short nipples or a stud of pipe. Exclusive with Nye, the *SKIP TOOTH* die.
7. **NYE THREE WAY TRIAD STOCKS**
   Uses same dies as the RATCHET STOCK. ⅜" to ¾" and ½" to 1".
8. **NYE COMBINATION VISE STAND**
   Base designed so yoke vise parts (⅛" to 2½") can be replaced by chain vise parts (½" to 4"), or vice versa. Legs lock in open or closed position.
9. **NYE HEAVY DUTY PIPE CUTTER**
   For use with power units. PAT. NO. 2556974. Three Roller Balancing. This self-aligning feature assures square cuts and eliminates spirals. Malleable sleeve covers and protects handle threads.
10. **NYE PIPE WRENCHES**
    Special lightweight alloy malleable handle; forged jaws. 50 years of experience in design and manufacturing behind them.





Long Sleeve for Thread Protection

NYE

NYE TOOL COMPANY
4122 FULLERTON AVENUE
CHICAGO 39, ILL.

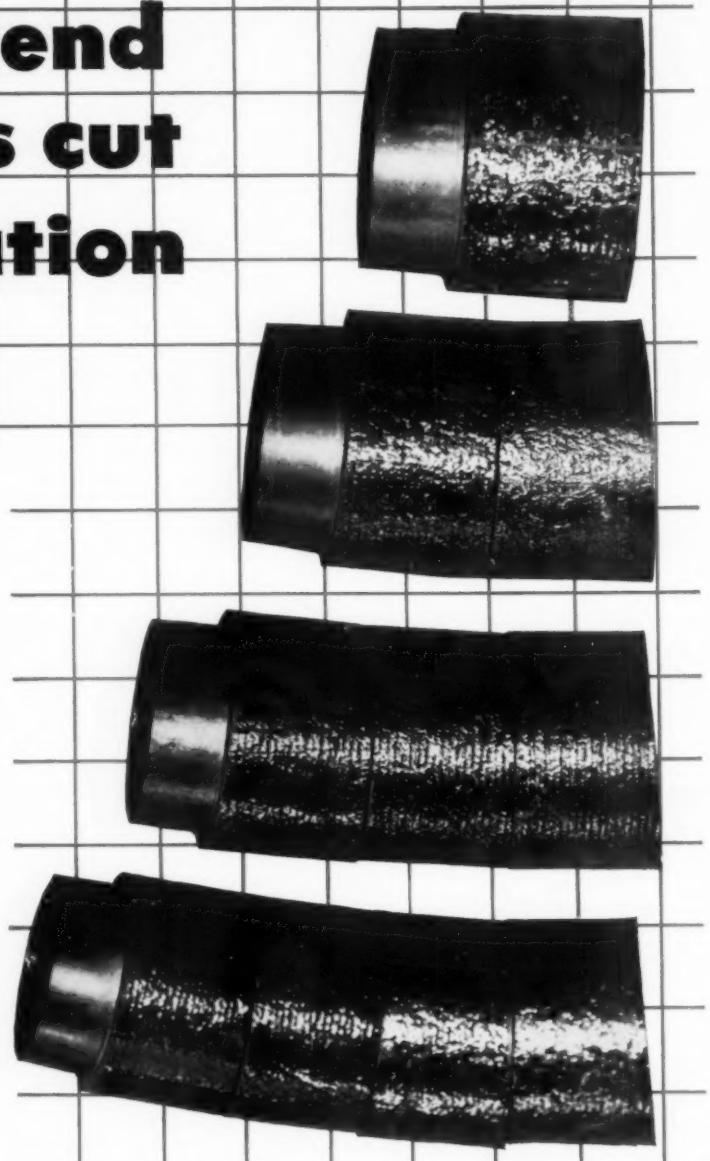
"The Tools You Swear By... Never At!"

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical

These bend sections cut installation costs



Orangeburg 5° Bend Sections are the "on-the-job" answer to special bend problems. They get over, under or around those unforeseen obstructions . . . and do it easily and economically.

Crossovers . . . transformations . . . offsets . . . can be made in the field by joining sections together to obtain the desired direction change. No costly delays . . . no special bends needed.

Orangeburg 5° Bend Sections* are another reason why Orangeburg Fibre Conduit is the ideal protective raceway for underground electrical cables.

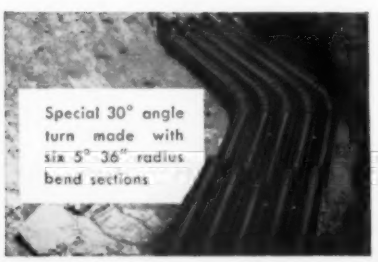
For complete information write Dept. EC-48 for Bulletin S.E.C.

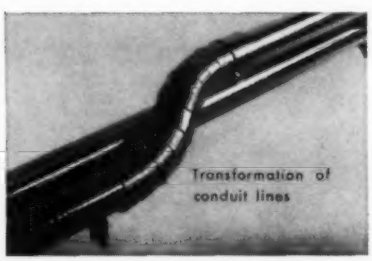
**Made for Orangeburg Standard Conduit only.*

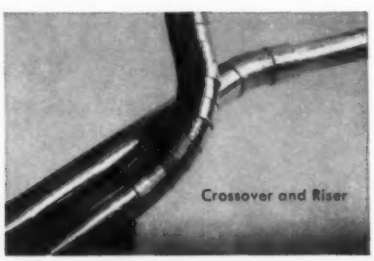
ORANGEBURG MANUFACTURING CO., INC.
Orangeburg, N. Y. Newark, Calif.

ORANGEBURG®

FIBRE CONDUIT PROLONGS CABLE LIFE







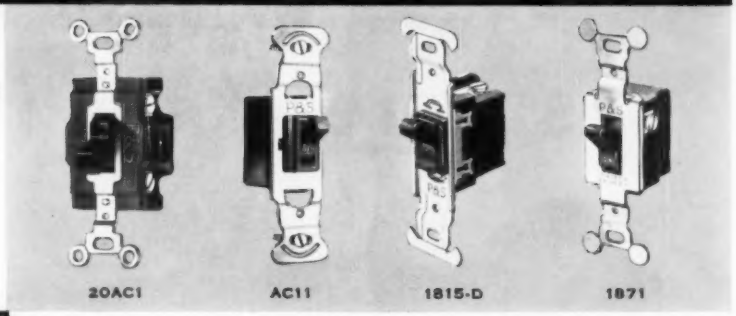
To spot what's NEW and best for you

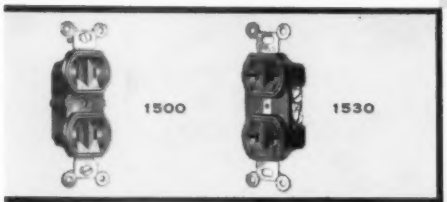
call GraybaR first for . . .

Everything Electrical GraybaR ELECTRIC COMPANY

THERE'S A P&S QUALITY WIRING DEVICE FOR EVERY REQUIREMENT

SWITCHES – A complete line . . . heavy duty 20 Amp AC . . . T-Rated . . . residential . . . a switch for every job.

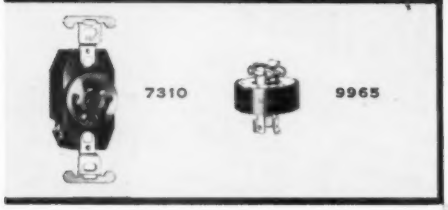




OUTLETS – A range to meet every need. Shown are the 1500 with time-saving screwless terminals and the 1530 T-Slot with dead back.

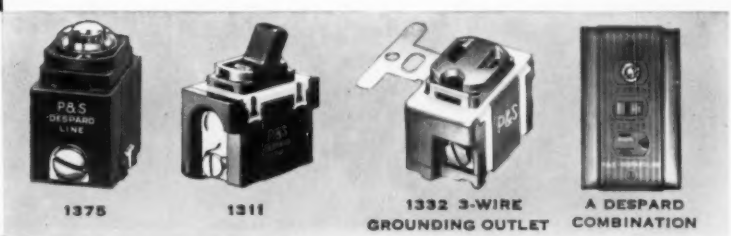
3-WIRE GROUNDING DEVICES – A full line of outlets, caps, connectors in 125 V and 250 V types.

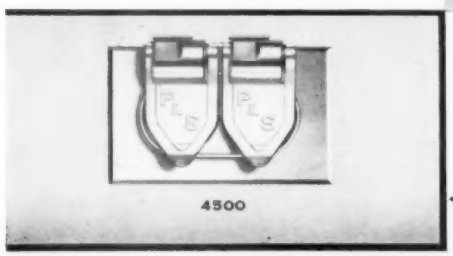
POLARIZED DEVICES – Available in 2, 3, and 4-wire . . . 15 and 20 Amps . . . outlets, caps and connectors . . . all built to take a beating.



TURNLOK – Sturdily built outlets, caps, connectors . . . 2, 3, and 4-wire, 10 and 20 Amps.

DESPARD LINE – The original and only complete interchangeable line . . . super-compact, highly versatile. Combinations assemble in seconds with P&S-Despard camstrap.





WEATHERPROOF COVER – Makes any standard duplex outlet a weatherproof device.

Standardize on Pass & Seymour Devices

P&S

PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK
60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill.
In Canada: Renfrew Electric Limited, Renfrew, Ontario

To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical

the O.Z. SHURELUG

has more of the features you want...

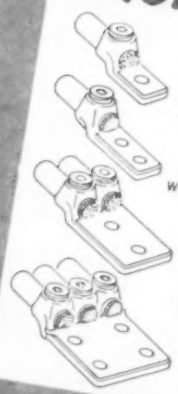
O.Z. means more for you

The O. Z. ShureLug is the newest addition to the complete O. Z. line of electrical fittings; more proof of O. Z.'s policy to make available dependable products at realistic prices.

MORE SIZES

The new O. Z. ShureLug is available for a wide range of sizes, including "in between" sizes usually found only in more expensive makes. This means that whether the job calls for #14 sol. or 1000 MCM cable, there will be an O. Z. ShureLug that will meet your needs more closely, more exactly, for a more secure, more dependable connection.

MORE MODELS



Here's variety too!: O. Z. ShureLug is available in single barrel, double barrel, and triple barrel models . . . with socket heads or hex heads . . . in single hole, double hole, and four hole styles, depending upon sizes selected. Here again, premium selection at practical prices!

MORE ECONOMY

O. Z. ShureLugs are priced no higher than other competitive brands, but you get so much more! Because O. Z. ShureLug is made in more sizes, more models, you buy only the capacity you actually need . . . only the capacity that you'll actually use. Why spend more for over-sized lugs when O. Z. has the size you want, the model you need, at the low economical prices you want to pay?

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND STREET • BROOKLYN 17, N. Y.

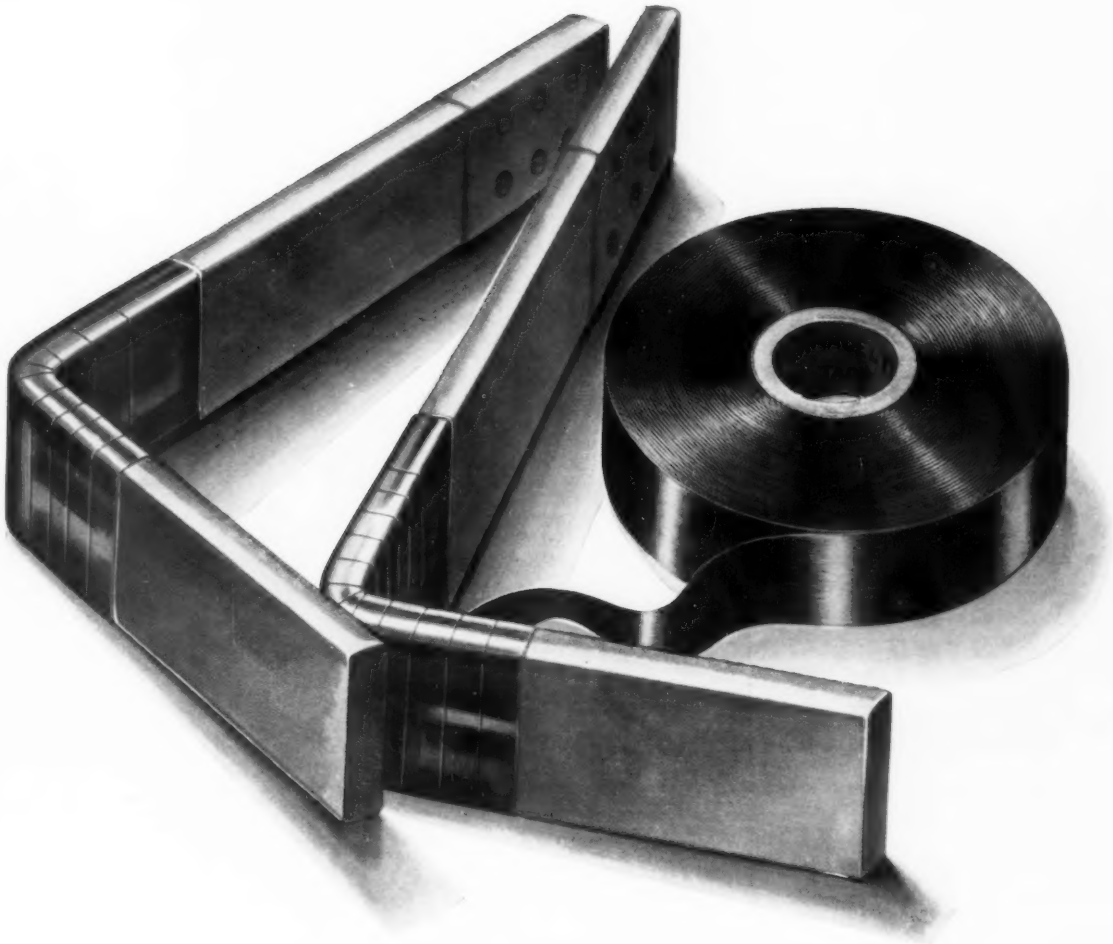
CAST IRON BOXES
CABLE TERMINATORS
POWER CONNECTORS
SOLDERLESS CONNECTORS
GROUNDING DEVICES
CONDUIT FITTINGS

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • ESterbrook 9-0326
Office and Factory: 749 Bryant Street, San Francisco 7, Calif. • GArfield 1-7846

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR ELECTRIC COMPANY



whatever the job . . .

PERMACEL® TAPE

PERMACEL-LEPAGE'S INC. *New Brunswick, N. J.*

TAPES • ADHESIVES • ELECTRONIC AND CHEMICAL MATERIALS

To spot what's NEW and best for you

call GraybaR first for . . .

Everything Electrical GraybaR

NEW EMS SERIES
Magnetic,
across-the-line
Motor Starters

INDUSTRIAL CONTROL PYLETS®

EXPLOSION-PROOF AND DUST-TIGHT

FOR HAZARDOUS LOCATIONS

SECOND TO NONE FOR . . . SAFETY AND ECONOMY . . . LONG SERVICE LIFE

New ECB Series Circuit Breakers

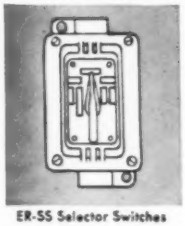
NEW

CORROSION-PROOF COVER JOINT:

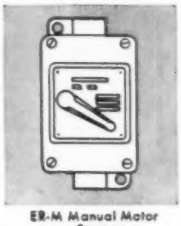
The metal to metal joints of all explosion-proof Pylets, both the ground joint types and the threaded joint types, are cadmium plated to maintain the integrity of the flame arresting path against corrosion. Only cadmium plate can provide this valuable protection on ferrous alloy castings.

The new EMS motor starters, ECM combination motor starters and ECB circuit breakers have cadmium plated, ground cover joints plus the following features:

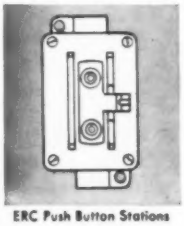
- COMPACT RECTANGULAR SHAPE
- HINGE SUPPORTED COVER
- RAIN-TIGHT PROTECTION
- COMPLETE ACCESSIBILITY FROM FRONT
- MINIMUM BENDING OF CONDUCTORS
- TAPERED TAPPED HUBS



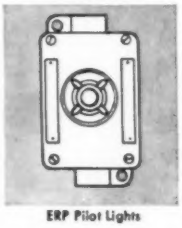
ER-SS Selector Switches



ER-M Manual Motor Starters



ERC Push Button Stations



ERP Pilot Lights

SINCE 1897

Sold Nationally Through Authorized Distributors. Write for Literature.

THE PYLE-NATIONAL COMPANY

WHERE QUALITY IS TRADITIONAL

1344 North Kostner Avenue, Chicago 51, Illinois

BRANCH OFFICES AND AGENTS IN PRINCIPAL CITIES OF THE U.S. AND CANADA • CANADIAN AGENT: THE HOLDEN CO., LTD. MONTREAL • RAILROAD EXPORT DEPARTMENT: INTERNATIONAL RAILWAY SUPPLY CO., 30 CHURCH ST., NEW YORK 7, N.Y. • INDUSTRIAL EXPORT DEPARTMENT: ROCKE INTERNATIONAL CORP., 13 E. 40TH ST., NEW YORK 16, N.Y.

CONDUIT FITTINGS • PLUGS AND RECEPTACLES • LIGHTING FIXTURES • FLOODLIGHTS

To spot what's NEW and best for you

call GraybaR first for . . .

Everything Electrical GraybaR

never before!

COMPACT, LOW-WEIGHT CONNECTORS WITH HIGH CURRENT RUPTURING RATINGS*

The new industrial series "C" Pyle-Star-Line connectors combine unique insulation and construction characteristics which make possible extraordinarily high circuit breaking ratings for the size and weight of the shell.

"Sandwich Insulation"—a resilient silicone insulation disc which floats between two rigid discs absorbs shock and vibration and permits the contacts to align themselves. The silicone, under pressure, reacts like a fluid. It flows into all crevices about the contact pins and sockets — positively prevents moisture or dust from passing through the insulation or accumulating to cause failures from short circuits or grounds.

Contact Inserts

Tough Hard Anodic Coating of shell has high dielectric qualities. A minimum of 1800 volts is required to puncture it.

Rugged, Compact, Low-Weight Shell machined from high tensile strength aluminum...combined with the unique insulation features provide a safe reliable, easy-to-handle connector which is highly resistant to the most punishing extremes of temperature, pressure, shock, vibration, corrosive dusts and moisture. Advantages never before combined in a single, standardized connector!

**Listed by the Underwriters' Laboratories, Inc. in 30, 60, 100, and 200 ampere, 600 volt A.C. circuit breaking ratings.*

Write for 62-page catalog, No. 1252-I

SINCE 1897

THE PYLE-NATIONAL COMPANY

WHERE QUALITY IS TRADITIONAL

1344 North Kostner Avenue, Chicago 51, Illinois

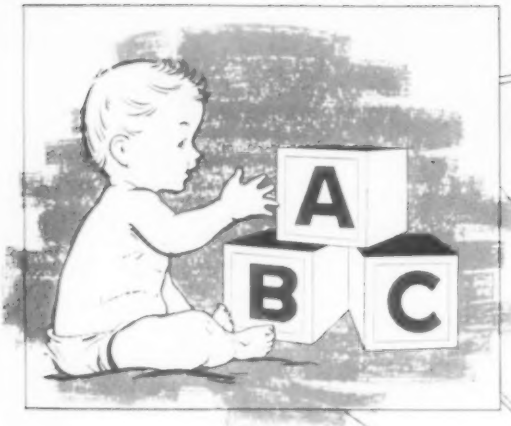
BRANCH OFFICES AND AGENTS IN PRINCIPAL CITIES OF THE U.S. AND CANADA • CANADIAN AGENT: THE HOLDEN CO., LTD. MONTREAL • RAILROAD EXPORT DEPARTMENT: INTERNATIONAL RAILWAY SUPPLY CO., 30 CHURCH ST., NEW YORK 7, N.Y. • INDUSTRIAL EXPORT DEPARTMENT: ROCKE INTERNATIONAL CORP., 13 E. 40TH ST., NEW YORK 16, N.Y.

CONDUIT FITTINGS • PLUGS AND RECEPTACLES • LIGHTING FIXTURES • FLOODLIGHTS

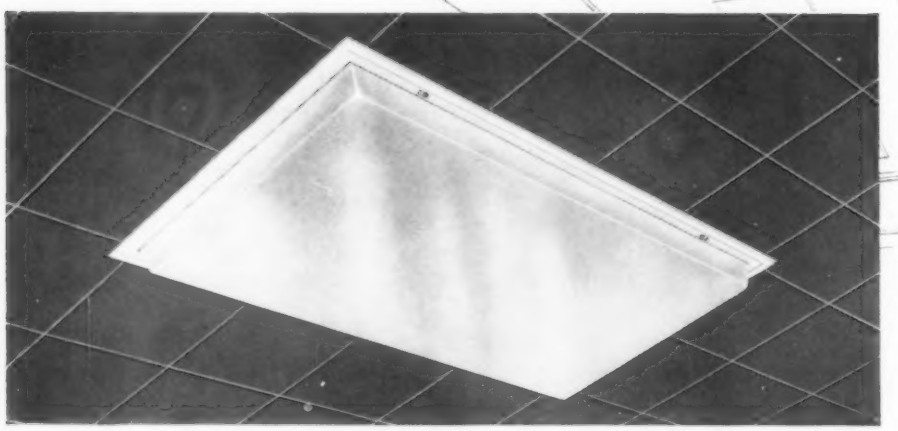
To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR ELECTRIC COMPANY



MODULAR UNITS
make the job simple!



3 BASIC MODULAR TYPES

A RECESSED AR-SERIES

Designed exclusively for recessed mounting and particularly adaptable for ceilings with low "head-room." A variety of closure styles provides complete application versatility. Each unit is wired ready to install—less lamps.

B THE SHALLOWLINE

Extremely shallow surface mounted modular units that give a built-in look, consistent with modern interiors. Units can accommodate varying numbers of lamps to achieve light intensities desired.

C AS-SERIES

Soon to be announced—a complete new line of shallow, surface mounted modular units, designed to accommodate different closures for complete versatility, efficiency and beauty.

PITTSBURGH'S NEW MODULAR LINE PROVIDES OVER 400 LIGHTING COMBINATIONS

These dimensionally accurate fluorescent modular units come in squares or rectangles for surface or shallow mounting. They can be used individually, continuously or at right angle combinations to form many pleasing light patterns. Attractively styled, they contribute to the beauty and efficiency of modern interiors.

And like all Pittsburgh Reflector equipment, these modular units offer the added advantages of high lighting efficiency and minimum maintenance. Their low cost makes it easy on the budget, too!

New comprehensive bulletins are available—Bulletin Z for recessed mounting and Bulletin O for shallow-surface mounting.

WRITE **FOR COPIES**

PITTSBURGH REFLECTOR COMPANY
404 Oliver Building, Pittsburgh 22, Pa.
Lighting Engineers in All Principal Cities of the United States
In Canada: Pittsburgh Reflector of Canada, Ltd., 105 Tycos Drive, Toronto

PITTSBURGH LIGHTING EQUIPMENT IS DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

ANCHOR ANYTHING TO MASONRY

with these

RAWL PRODUCTS:

RAWLPLUGS

FOR SHEET METAL SCREWS • STANDARD WOOD SCREWS • LAG SCREWS

Rawlplugs are the only truly universal masonry anchors . . . they hold securely in *any* masonry material. They won't fracture brittle or fragile material—have been installed in glass!

Rawlplugs are adaptable to all types of gimlet-pointed sheet metal screws, standard wood screws or lag screws. Diameters and lengths available for every screw size from #6 through ⅜".

Measured in terms of holding power or size of fastener, Rawlplugs require a smaller drilled hole than any other masonry anchor. The "elastic-compression" expansion that gives the Rawlplug its holding power soaks up vibration . . . no creeping or failure.

RAWL SCRU-LEADS

Lead Screw Anchors for sheet metal screws and standard wood screws. The most holding power possible with any lead screw anchor.

Exclusive Rawloy, lead alloy especially developed for masonry anchors, used for ease of installation and sure holding power.

Flange permits use in hollow material.

RAWL LAG-SHIELDS

Lag Screw Expansion Shields

The Rawl Lag Screw Shield is a completely rustproof precision-cast lag shield made of durable alloy.

Ideal for all masonry fastening, especially where problem masonry is encountered.

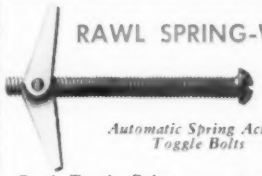
Horizontal fins prevent shield from turning in hole.

Tapered outside rings have tremendous biting power.

RAWL DRIVES

Rawl-Drives are the world's only one-piece expansion bolts—they drive like a nail; hold like a bolt.

Fast, easy installation—no hole spotting or layout needed. Drill through fixture hole, hammer Rawl-Drive home through fixture hole.



RAWL SPRING-WINGS

Automatic Spring Action Toggle Bolts

Rawl Toggle Bolts are rustproof and have a positive automatic spring action for easy installation in Hollow Walls, Pressed Board Walls, Tile, Sheet Metal, etc.

RAWL CALK-INS

Machine Screw Caulking Anchors

Improved machine screw anchor. Sleeve is precision-cast of Rawloy, exclusive lead alloy especially developed for masonry anchors—Just soft enough for easy, complete caulking and hard enough for tremendous holding power.

FREE caulking tool included in every box.

RAWL HAMMER-SETS

Non-Caulking Anchors For Machine Bolts

Shallower hole required than all other machine bolt anchors. Excellent for heavy holding requirements in hollow material —cement and cinder block, hollow tile, etc. Can be used at any depth in a hole, thus can be set beneath plaster or other soft surface materials.

RAWL MULTI-CALKS

The Heavy-duty Bolt Anchor

A caulking masonry anchor for the really big jobs.

Caulking sleeve cast of Rawloy, the masonry anchor alloy, for complete caulking and secure holding.

Lugs on cone prevent its turning as nut is tightened on bolt.

Your GRAYBAR representative is TRAINED to help you solve MASONRY ANCHORING PROBLEMS

THE RAWLPLUG COMPANY, Inc., 212 PETERSVILLE ROAD NEW ROCHELLE, N. Y.

SAVE TIME and MONEY

with these

RAWL DRILLS and ACCESSORIES

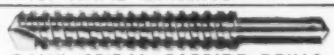
All Rawl percussion drills are three pointed for easy sharpening and faster drilling.

MACHINED (M/T)

TWIST TYPE (R/T)

FORGED TAPER-SHANK DRILLS for POWER HAMMERS (T/S)

FORGED DRILLS for HAND DRILLING (S/T)



RAWL SPIRAL CARBIDE DRILLS

RAWLDRILL Accessories

RAWL DRILL-HAMMER

Quickly converts a ¼" high speed electric drill to a fast power hammer. Weight—2¾ pounds. Weight of blow —adjustable to "light," "medium" or "heavy." Construction — only three moving parts all of hardened steel. Designed to withstand the most severe treatment. Capacity—Rawl #14 adapter for No. 6 (5/32") to No. 14 (9/32") Rawldrills (M/T or R/T). Rawl #20 adapter for No. 16 (5/16") to No. 20 (⅜") Rawldrills (M/T or R/T).

In order for GRAYBAR men to be of more service to you, they have attended RAWLPLUG "Anchorama" TRAINING school. They know which anchor best fits your application and why. Ask your trained GRAYBAR salesman for his recommendations.

The RAWLPLUG COMPANY, Inc.
212 Petersville Road, New Rochelle, N. Y.

To spot what's NEW and best for you

call GraybaR first for . . .

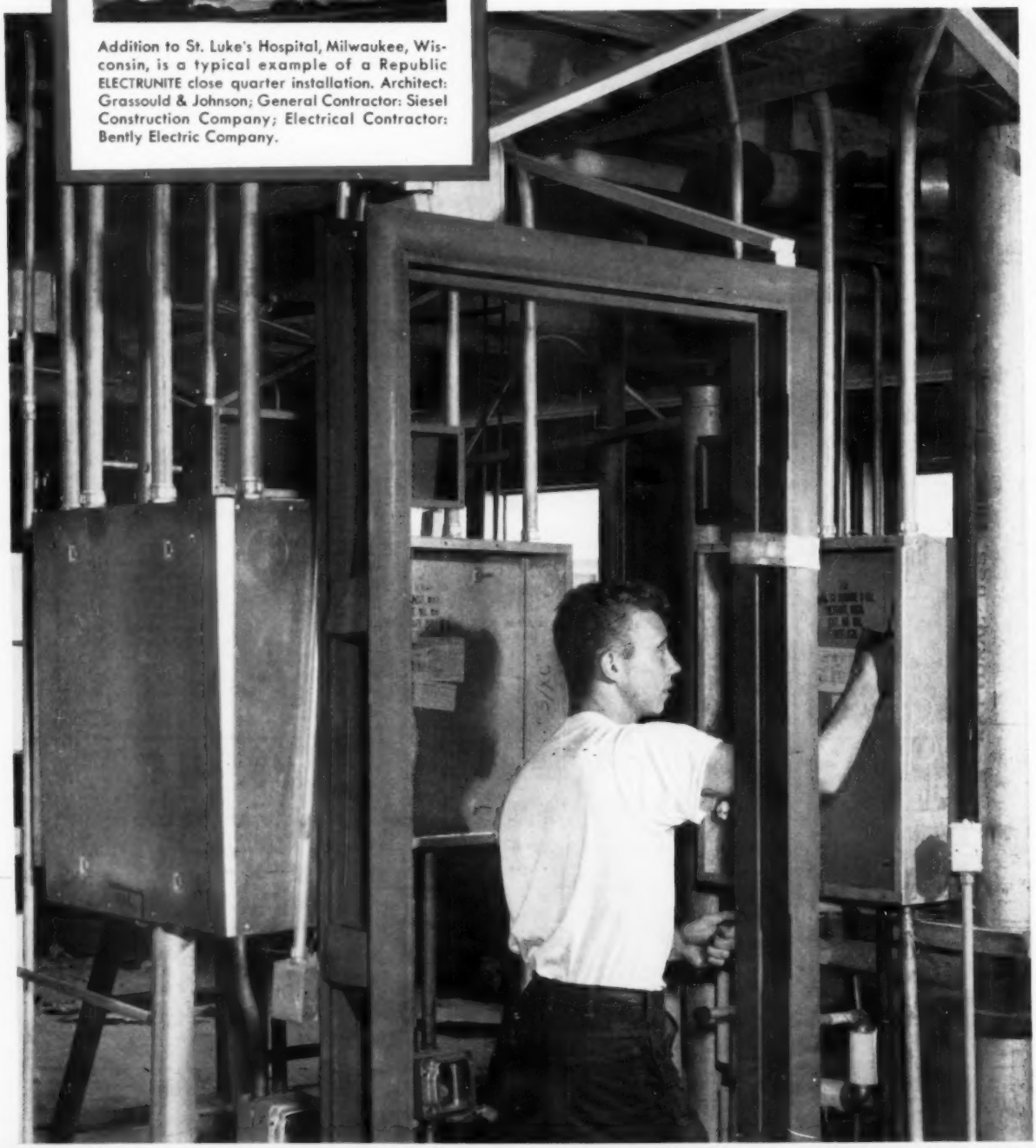
GraybaR Everything Electrical GraybaR

Addition to St. Luke's Hospital, Milwaukee, Wisconsin, is a typical example of a Republic ELECTRUNITE close quarter installation. Architect: Grassould & Johnson; General Contractor: Siesel Construction Company; Electrical Contractor: Bently Electric Company.

QUALITY MAKES THE BIG

install Republic

THE BEST



To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

DIFFERENCE IN CLOSE QUARTER INSTALLATIONS

ELECTRUNITE E.M.T. because

COSTS LESS INSTALLED

Install Republic ELECTRUNITE® E.M.T. Deliver a top quality job at the best bid because . . . the *best* costs *less* installed. Built-in quality makes the big difference.

Republic ELECTRUNITE E.M.T. is produced from highest quality flat-rolled open-hearth steel made in Republic's own mills and carefully inspected to Republic's rigid manufacturing requirements. Quality is built-in.

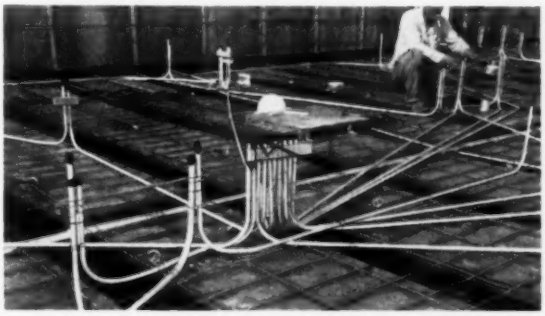
Republic ELECTRUNITE "INCH-MARKED" in feet and inches up to 1¼″ sizes is an exclusive easy-to-use feature that offers installation economies. Full length "GUIDE-LINE" keeps bends in line, saves wasted time and material. And "INSIDE-KNURLING", another exclusive ELECTRUNITE feature, makes wire pulling as much as 30% easier. Additional examples of Republic's built-in quality.

Lightweight, easy-to-handle ELECTRUNITE is the most practical and economical raceway in close quarter installations, too. To make tight joints, simply tighten the fitting, not the entire run—a real aid where working space is limited.

And because quality is built-in Republic ELECTRUNITE E.M.T. meets building code requirements...is produced to A.S.A. Specification C.80.3 and Federal Specification WW-T-806, (latest revisions) and carries the Underwriters' Laboratories Seal of Inspection.

Install quality—install Republic ELECTRUNITE E.M.T. For additional information call your Republic ELECTRUNITE distributor or send coupon today.

"GUIDE-LINE" extends the full length of ELECTRUNITE tubing. By properly aligning with the calibrations on the Republic bender, bends are kept in the correct plane, avoiding costly "wows", wasted time and material. Both "INCH-MARKED" and "GUIDE-LINED" features are available in ½″, ¾″, 1″ and 1¼″ sizes.



Strong, sturdy, Republic ELECTRUNITE E.M.T. is the ideal electrical raceway conduit for concrete installations. Special galvanized finish protects every inch of Republic ELECTRUNITE, will not chip, peel or flake even when the tube is bent. Another built-in quality reason for specifying Republic ELECTRUNITE.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION
DEPT. C-5065
221 EAST 131st STREET • CLEVELAND 8, OHIO

I would like to learn more about Republic ELECTRUNITE "INCH-MARKED" and "GUIDE-LINED" E.M.T. Features.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

For the best in outdoor lighting see your Revere wholesaler

No matter what your outdoor lighting requirements, Revere has the dependable, easy-to-install lighting fixtures needed for your job.

Because Revere distributes through competent, experienced wholesalers, you are assured the benefits of helpful, friendly service when you buy Revere equipment.

Backing up Revere's extensive selection of lighting equipment are years of your wholesaler's experience — specialized experience in outdoor lighting problems to help you save time and pick the best fixtures for your lighting installation.

For your next outdoor lighting job, specify Revere, and see a lighting specialist — the Revere electrical wholesaler serving your area.

Ultra-Lite at right is Revere's latest in outdoor mercury illumination for large areas, such as parking lots and parks. Four 400-watt mercury lamps are housed under an attractive metal "dome". Lamps are positioned to provide a "square" light pattern. Light patterns overlap to increase fringe intensities and provide greater light uniformity. Ultra-Lite's large coverage reduces pole requirements 50 to 75%.

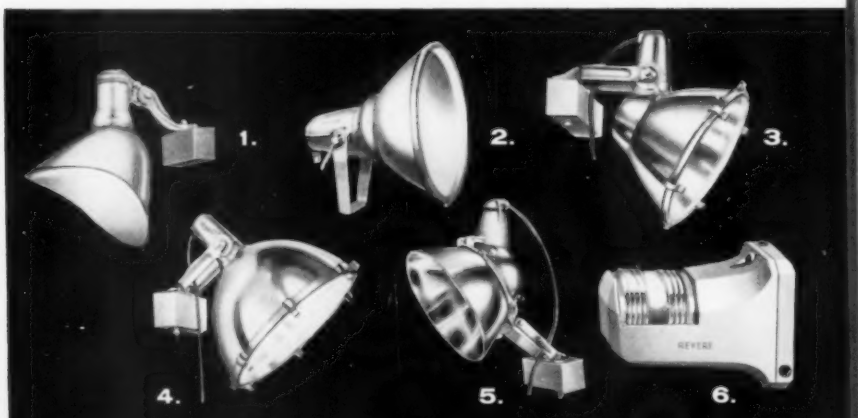
Heavy duty hinged pole for safe, economical lamp maintenance at ground level. Eliminates need for boom trucks or ladders. Sturdy construction. Weather-resistant.

Tapered, rigid octagonal pole at left is fabricated of 11-gauge *Cor-Ten* corrosion-resistant steel. Continuous welding, base to top.

Revere ELECTRIC MFG. CO.

OUTDOOR LIGHTING

Revere Electric Manufacturing Co.
7420 Lehigh, Chicago 31, Illinois



1. 3800 Series Eliptor floodlights for 300 to 1500-watt incandescent lamps. Aluminum or vitreous-fired, porcelained enameled steel in selection of colors. Degree marked for settings.

2. 7100 Series open or enclosed floodlight for 200 to 1000-watt incandescent lamps. Wide or narrow beam Alzak aluminum reflectors.

3. 4200 Series enclosed flood for efficient lighting of large areas. Wide or narrow beam reflectors. Dust-tight and weather-proof. For 750, 1000, or 1500-watt incandescent lamps. Swing-over feature for easy servicing.

4. 7400 Series floodlight for 1000-watt mercury lamps. Provides exceptionally high light output. Choice of clamp or hinge type 24-inch lens holders. Weatherproof, lightweight.

5. 2000 Series 20-inch flood for 750, 1000, or 1500-watt PS-52 lamps. Rear section access for relamping. 20° or 50° spread. Alzak aluminum reflectors. Permanent watertight seal.

6. 3151 Series underneath floodlight for even lighting on plane surfaces. Weatherproof, and insect-proof. Flat surface mounting.

7. Bracket for two floodlights of standard steel pipe with pipe stubs welded for one piece construction. Bracket threaded at bottom center to accommodate 2 or 3-inch mounting pipe.

8. Bracket for three floodlights, same construction as above. Pipe stubs centered on 2-foot spacings. Revere floodlight brackets are available from stock for up to 10 floodlights.

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

RAY-O-VAC® HEAVY-DUTY

Industrial Flashlights and Batteries

"WORKMAN"
No. N22—2-cell
No. N32—3-cell
Shortproof industrial flashlight

The Ray-O-Vac line of heavy-duty industrial flashlights and batteries has been specifically designed to meet the most rugged demands of modern industry. Always look to Ray-O-Vac to meet the needs for portable light.

ORDER TODAY FROM
YOUR NEARBY GRAYBAR BRANCH

RAY-O-VAC COMPANY • MADISON 10, WISCONSIN

Division Offices: 212 East Washington Ave., Madison 10, Wisconsin. 1388 Madison Avenue, Memphis 4, Tennessee. 461 Market Street, San Francisco 5, California. 1775 Broadway, New York 19, New York. Ray-O-Vac Canada, Ltd., Winnipeg.

N22T Continuity Tester. Combination flashlight and continuity tester.

941 Lantern Battery...Raysol additive extends shelf life; assures user of longer, more dependable battery service. Protects against leakage.

3LP Industrial Leak Proof Battery. Sealed-in-steel. Gives longer usable bright light. Guaranteed against corrosion damage to flashlights.

941

3LP

N22W8
"WORKMAN" flashlight
with signal wand.

new RAYSOL added!

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

Simplex

ANNOUNCES the C-L-X* Sheath

...an entirely new closed system that gives incomparable benefits in all types of cable installations

Simplex C-L-X is a Continuous Lightweight eXterior metallic sheath that is impervious to gases, chemicals and water. Its unique construction gives it a combination of properties that is unmatched by any cable system now manufactured in the United States.

C-L-X provides a completely sealed conduit — with "built-in" cable. C-L-X combines all the advantages of lead sheathed and interlocked armored cables. In addition, it has its own intrinsic qualities of great strength with extremely light weight. It is suitable for installation in trays or by clamps. C-L-X can be used aerially or buried directly in the ground. Its pliability permits ease of installation.

For more than a decade, this type of cable protection has given exceptional service in European installations. *Now, Simplex engineering has adapted C-L-X so that its scope of industrial applications is practically unlimited for modern American installations.* It is unequalled in situations where impermeability and durability are important.

Like all Simplex products, C-L-X is engineered for lasting quality and, therefore, *dependability*. Write for specific product data.

*(Continuous Lightweight eXterior, pronounced "Sealex")

LIVE BETTER ELECTRICALLY

Simplex WIRE & CABLE COMPANY

79 SIDNEY STREET, CAMBRIDGE 39, MASS.

"the American manufacturers of transoceanic telephone cables"

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

SALISBURY'S

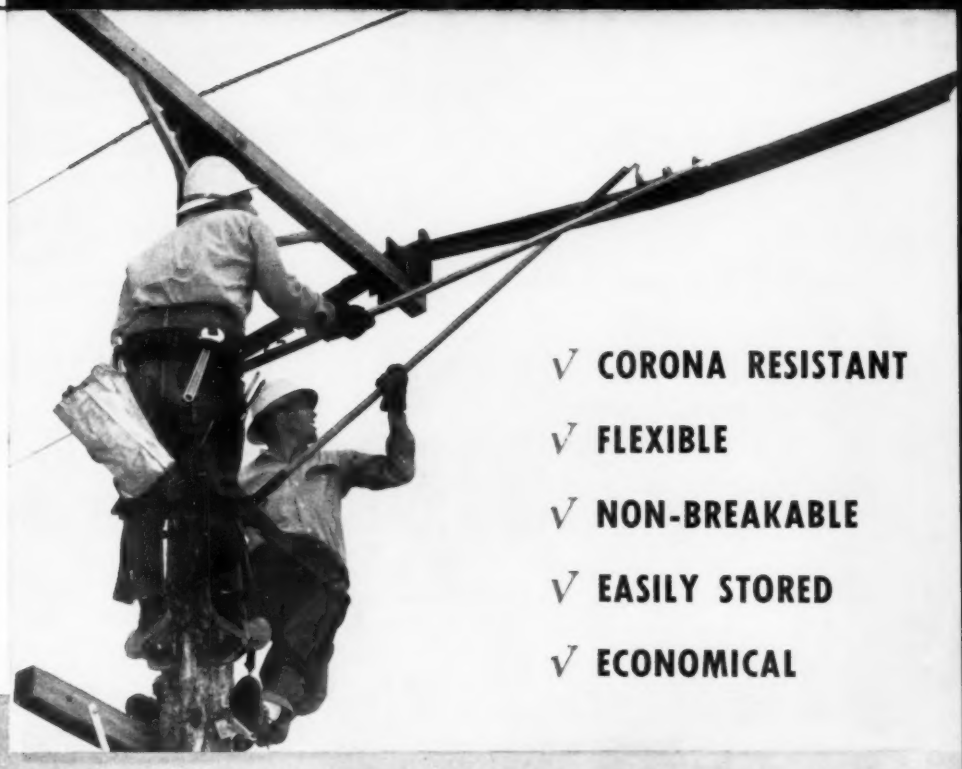
New!

UBANGI LINE HOSE

UBANGI INSULATOR HOODS

CORONA RESISTING BLANKETS

For use with live line tools on circuits which are energized up to and including 15,000 volts.



- √ CORONA RESISTANT
- √ FLEXIBLE
- √ NON-BREAKABLE
- √ EASILY STORED
- √ ECONOMICAL

ESTB. MANUFACTURERS SALISBURY CHICAGO RUBBER PRODUCTS 1855

The World's Largest Manufacturers of

LINEMEN'S RUBBER PROTECTIVE EQUIPMENT

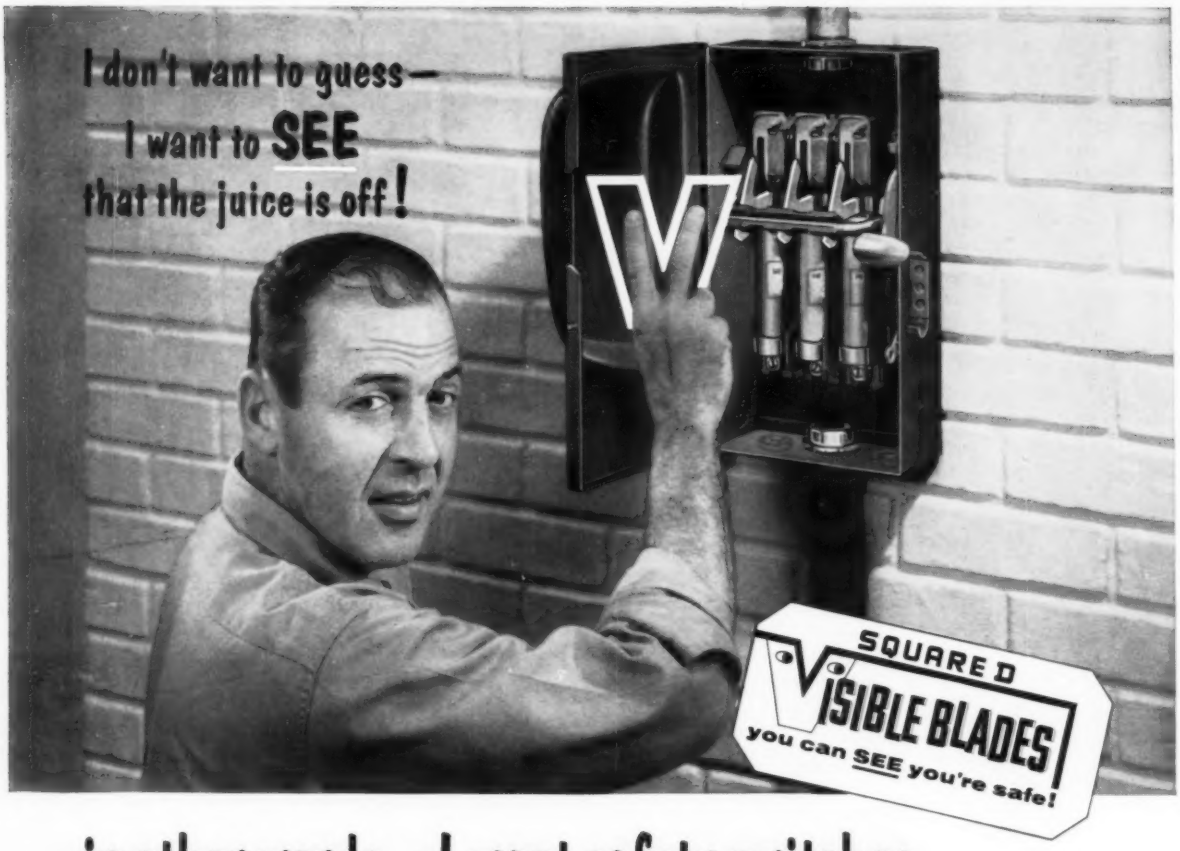
W. H. SALISBURY & CO.

Morgan & Kinzie Streets • Chicago 22

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR



...in other words—I want safety switches with VISIBLE BLADES!

The men who pull the switches will tell you what can happen when a switch, *believed* to be open—*isn't.* A lot of things can happen—and every one of them is bad. Personnel is in danger. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

Doesn't it make sense to insist on **V**isible Blade construction which gives you a road block against any of these possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages?

100,000-ampere SHORT CIRCUIT Capacity —*Another Plus Feature*

Square D safety switches equipped with high capacity current limiting fuses provide full protection on even the highest electrical loads. Independent tests by a high capacity laboratory on Square D safety switches — rated at 30 through 600 amperes—subjected the switches to both open and closed tests on 100,000 ampere short-circuited systems. *Not one Square D switch showed any sign of failure!* Further proof that Square D switches provide *plus* safety. They cost no more—why settle for less?

SAFETY SWITCHES and other Square D products are distributed by GRAYBAR

SQUARE D COMPANY

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR ELECTRIC COMPANY

MORE LIGHT for the MONEY with the NEW POWER-GROOVE INDUSTRIALS by SMITHCRAFT

Up to 2½ times higher lighting levels can be obtained with a given number of fixtures *at a lower initial cost per footcandle*. Smithcraft and Power-Groove are now combined to give employees a better, more productive see-level and to save employers *real money*.

Smithcraft Power-Groove Industrials are beautifully constructed industrial units that utilize the very high lumen output of the new Power-Groove lamps to provide real economic advantage along *with comfortable lighting*. These units, designed for top value and for very long-term use in today's factories, mean that you can save between 5 and 20% on your initial lighting investment. Ask your Man from Smithcraft.

POWER-GROOVE INDUSTRIALS *by Smithcraft are quickly and economically mounted, individually or in continuous rows, using any conventional method. Reflectors, ribbed for extra strength, are available in Smithcraft White Porcelain Enamel or in Smithcraft Bonderite and Baked White Enamel Finish. Louvers for 30° lengthwise shielding are optional.*

Smithcraft POWER-GROOVE and MONITOR Industrials feature:

- Ribbed reflectors for extra strength.
- Scientifically-designed collared apertures.
- Reflector couplings are plastic inserts, sealing light leaks and lining up reflectors in continuous row mounting.
- New-type turret lampholders hold lamps securely in place.
- Slanted lampholder front reduces dark area between fixtures.
- Reflectors are quickly released by easy-to-grasp captive catches.

THE MAN FROM SMITHCRAFT

Paul Wehner, Dayton, Ohio representative. Like every member of Smithcraft's nationwide sales organization, his ability to talk your language can mean a lot to your profit picture.

Smithcraft "AMERICA'S FINEST FLUORESCENT LIGHTING"

Smithcraft PV series for Power-Groove lamps. 25% uplighting.

Smithcraft PF series for Power-Groove lamps. 15% uplighting.

Smithcraft Monitor V-25 for Rapid-Start, Slimline or High Output lamps. 25% uplighting.

Smithcraft Monitor for Rapid-Start, Slimline or High Output lamps. 15% uplighting.

Smithcraft LIGHTING, CHELSEA 50, MASS.

PLEASE ATTACH TO YOUR BUSINESS LETTERHEAD and mail to

Smithcraft LIGHTING, CHELSEA 50, MASS.

NAME _____

TITLE _____ CO. _____

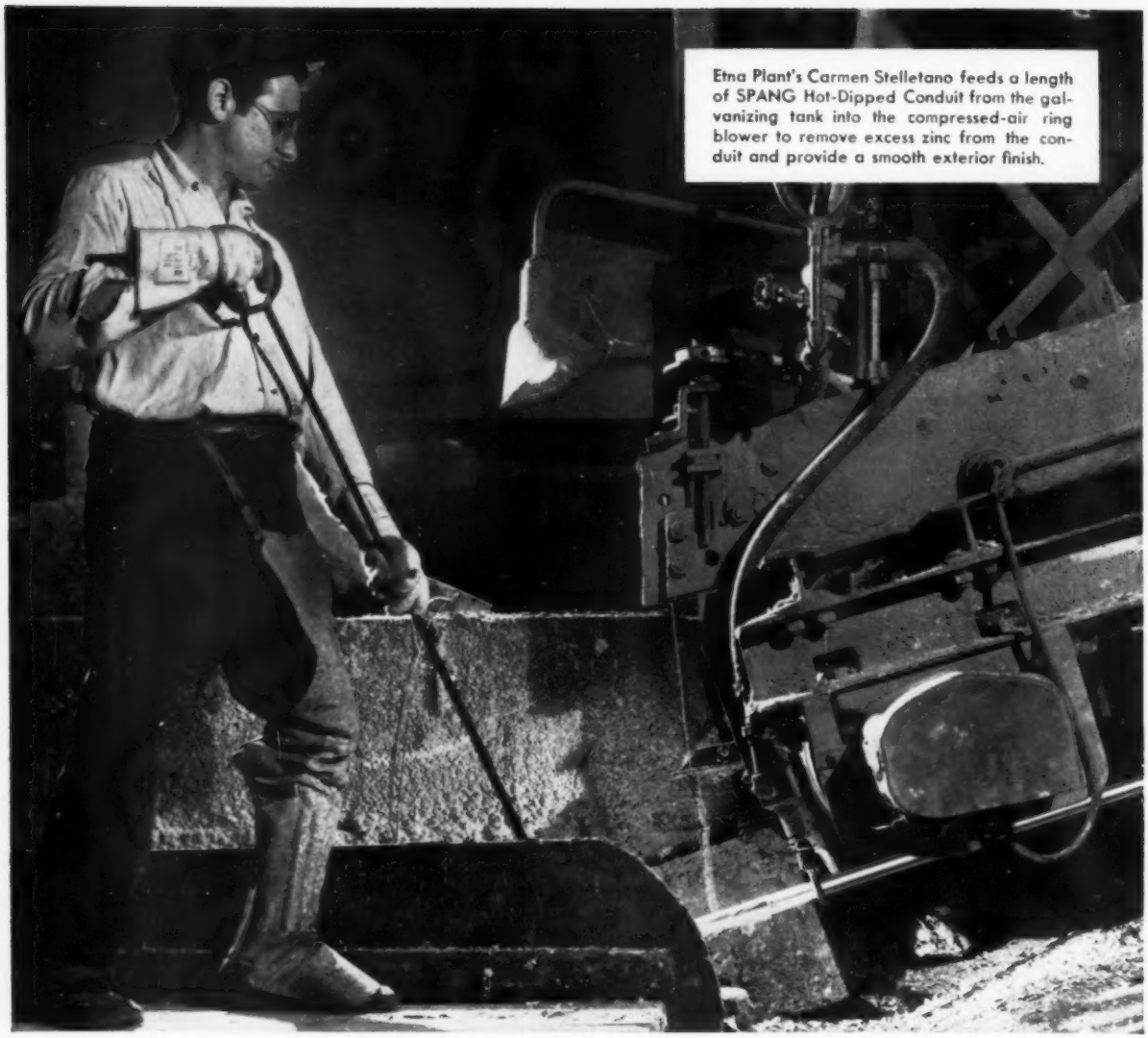
ADDRESS _____ CITY _____ STATE _____

- ☐ Please send me the monthly publication, "Light Side of the News", so that I can keep in touch with the latest trends in lighting.
- ☐ Please send me catalog information on the NEW SMITHCRAFT POWER-GROOVE and MONITOR INDUSTRIALS.
- ☐ Please send me the complete SMITHCRAFT CATALOG, containing data on America's Finest Fluorescent Equipment.

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY



Etna Plant's Carmen Stelletano feeds a length of SPANG Hot-Dipped Conduit from the galvanizing tank into the compressed-air ring blower to remove excess zinc from the conduit and provide a smooth exterior finish.

Out of this galvanizing tank comes the best rigid conduit* you can buy!

...*SPANG HD, of course!

AND HERE'S WHY...

UNIFORM STRENGTH—SPANG HD Galvanized Conduit is produced under close control during forming and welding to provide a uniform conduit that's easy to cut, bend and thread.

HEAVY-DUTY UNIFORM FINISH—of prime western zinc, air-wiped outside to produce a smooth even finish that will stand up under severe bending strains . . . blown inside with superheated steam to provide easy wire pulling.

HIGH CORROSION RESISTANCE—Quick quenching of the hot galvanized conduit in a sodium dichromate solution gives a strong bonding of the finish to the steel . . . helps retard formation of white rust . . . adds extra service life to the pipe. A protective coating of lacquer provides added resistance to corrosion.

SPANG CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
TWO GATEWAY CENTER, PITTSBURGH, PA.
District Offices and Sales Representatives in Principal Cities

NEXT JOB MAKE IT **SPANG** HD CONDUIT!

You'll get quality every time. Save money in the long run, too! There's a SPANG Distributor near you, ready to give you quality service on your order.

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

VIBRATING BELLS
Cat. No. 2000

AC "CM" BUZZER
Cat. No. 284 MI

AC UNI-PACT HORNS
Cat. No. 123-U Two-Way Projector

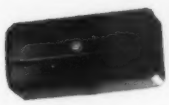
AC UNI-PACT HORNS
Cat. No. 121-U Megaphone Projector

AC WEATHERPROOF KODAIRE HORNS
Cat. No. 136

AC "CM" VIBRATING BELLS
Cat. No. ATL-700

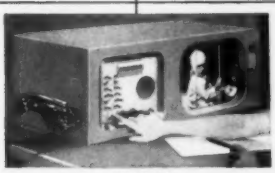
DC BUZZER
Cat. No. 101

Compressor Type
AIR TRUMPETS
Cat. No. 109-DC
Cat. No. 110-AC

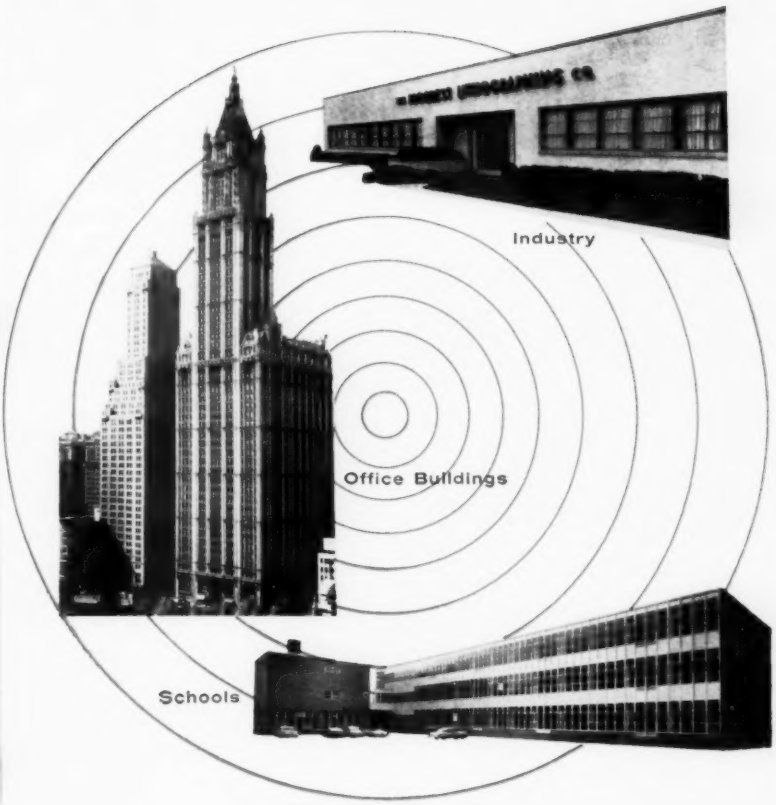


UTILITY CHIME
Cat. No. 1531

KODE MASTER
Page-Boy of your Organization
Cat. No. 805



VISACALL
Closed Circuit TV For Supervision of Hospital Patients
Visacall-6



Our business is communications

. . . a gentle chime . . . a blasting horn . . .
or a complete audio-visual communication system

Sperti Faraday leads in the instant sound or sight communication systems that speed today's business or institutional contacts. Whatever your problem, whether simple or complicated our engineers are at your service to assist you in designing the system that suits your needs.

This service is available to users without obligation. Simply call your nearest Sperti Faraday representative or write to Sperti Faraday, Inc., Adrian, Michigan. *In Canada*, write Sperti Faraday, Ltd., Montreal.

Sperti Faraday Inc.

SINCE 1875 DESIGNERS AND PRODUCERS OF VISUAL AND AUDIBLE SIGNALS

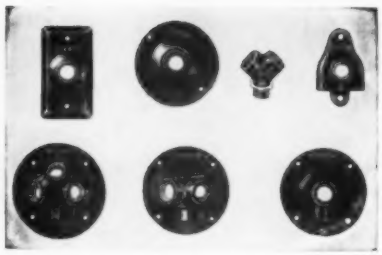
Adrian, Michigan

Specialists in: **FIRE ALARM SYSTEMS** • ELECTRICAL CLOCK SYSTEMS • HOSPITAL PATIENT OBSERVATION • CLOSED CIRCUIT TV • AUDIBLE SIGNALS • **ANNUNCIATORS** • CODED PAGING SYSTEM • SYNCHRONOUS CLOCKS • TRANSFORMERS • CONTACT DEVICES

To spot what's NEW and best for you

call GraybaR first for...

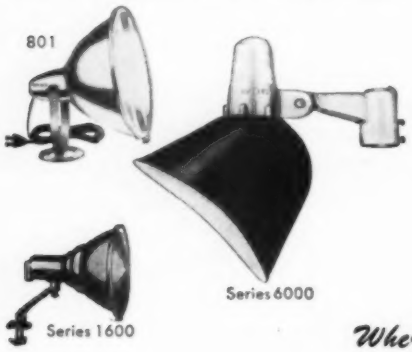
Everything Electrical GraybaR

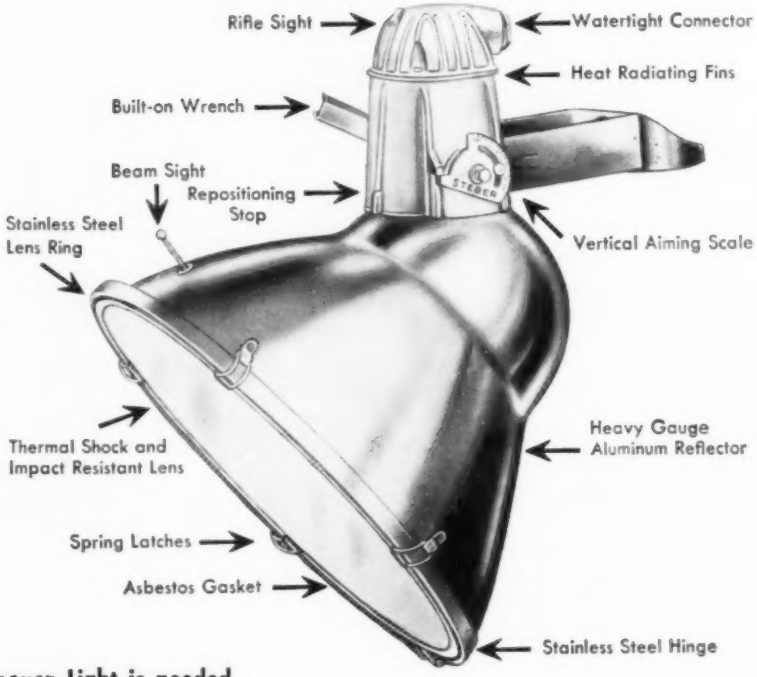


NEW STEBER SERIES "4000" Sports and Industrial Floodlights

Chrome Plated **STEBERLITES**

Open and Enclosed **FLOODLIGHTS**

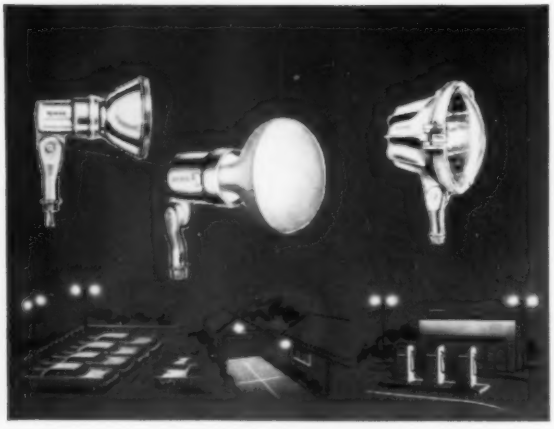




Wherever **Light is needed**

Whatever **the Lighting requirement**

STEBER *Lighting Fixtures Meet Your Specifications*



Lighting is Steber's business. For every need, large, medium or small jobs, high or low intensity flood or spotlighting, versatile Steber sealed beam components and fixtures do the kind of job you want . . . economically.

Steber Condensed Catalog CTC-1 gives complete details of units shown here and many other Steber items. Write for your copy now.

Sold Through Leading Distributors

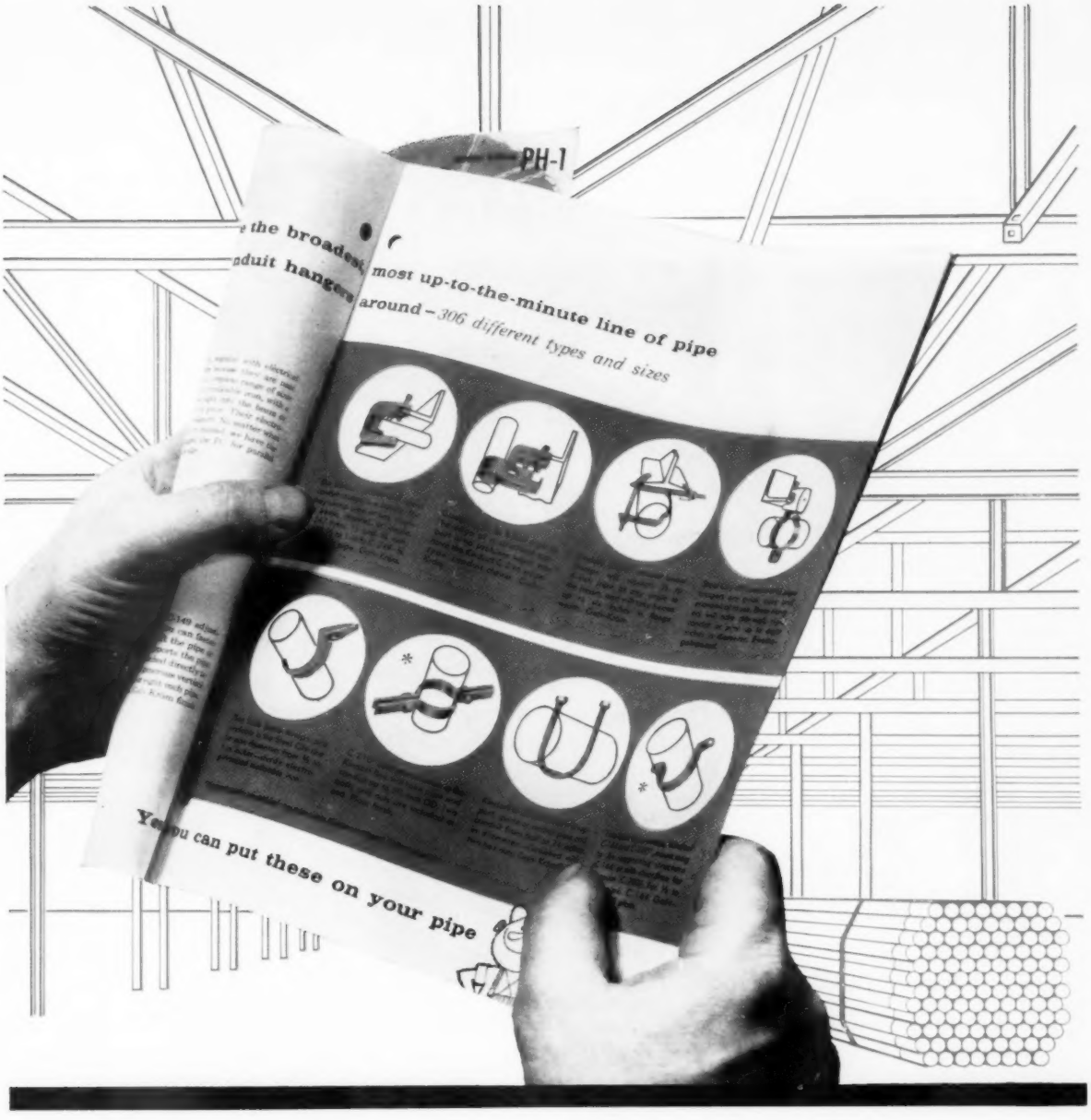
STEBER

STEBER MANUFACTURING CO.
Dept. 98
Broadview, Illinois

Steber Manufacturing Co. of California
242 So. Anderson St.
Los Angeles 33, California

Steber-Woodhouse Ltd.
33 Ingram Drive
Toronto, Canada

To spot what's NEW and best for you
call GraybaR first for . . .
Everything Electrical GraybaR



At Last – an answer to ALL your conduit hanging problems!

Here's the first *complete* line of conduit and pipe hangers ever offered by an electrical manufacturer — 306 different types and sizes. They're tailor-made to meet your special requirements. Send for our product bulletin PH-1 and stop wasting time and money working out your own solutions to the thousand and one pipe hanging details of your next job. You'll find big profit comes in small packages when you buy Steel City Pipe and Conduit Hangers.

products of

STEEL CITY ELECTRIC COMPANY

PITTSBURGH 33, PA.

To spot what's NEW and best for you

call GraybaR first for...

Everything Electrical GraybaR

FOR THE EXACT TOOL ON THE EXACT JOB CHOOSE

Powerful Thor Electric Tools

DRILLS Thor's series of universal electric drills have earned a reputation for high quality and outstanding performance. Stand-outs wherever durability and reserve power are desired. All ball-bearing construction and Thor-built motors assure long life on the job. In ¼" to 1¼" capacities. Complete range of speeds, angle attachments and accessories.

IMPACT WRENCHES You name the job, Thor has the impact wrench to fit. All Thor wrenches are reversible. Deliver two hard rotary blows for every spindle revolution. No torque reaction. Cannot stall or burn out. Prices start at a low $94.50 for a ½" drive wrench. Heavy duty ½" and ⅝", angle attachments, accessories, kits available.

HAMMERS Here's a pair of Thor utility hammers unmatched for quality or versatility. Model 15 air hammer has exclusive stop rotation. Four tools in one —demolition tool, drill, clay digger and chipping hammer. Weighs only 15 lbs. Need an electric hammer? Thor's U-100 hammer breaks up concrete, gouges or shapes wood—scales metal, drills stone, concrete.

THOR REVERSIBLE DRILLS—Heavy-duty Thor EJ9RT reversible drill has wide use by telephone and utility company linemen. Reversible feature is highly important for fast, easy withdrawal of bit from hole.

GRINDERS You can remove more metal per minute on the toughest jobs with Thor grinders. The secret is the smooth transmission of power through highest quality anti-friction bearings. Straight grinders in 4", 5" and 6" sizes. Angle grinders with 7" or 9" depressed centers for cut-off operations. Angle grinders in 4" and 6" cup wheel type for general grinding.

SAWS You can cut your lumber and your costs faster with any of the seven powerful Thor saws. Save costly labor time—build up profits per job. Just look at the selection you get: two 6¼" models, two 7½" models, 8¼", 10" and 12" models. Prices start at a low $49.95. 9 blade types and a variety of abrasive discs are offered as accessories.

For the tools that do more, you'll choose Thor every time because building quality tools has been Thor's only business for 64 years. We know how to make tools better and how to service them better. Thor maintains service facilities in twenty-three cities and sells only through qualified distributors. Choose Thor—for the exact tool on the exact job. Thor Power Tool Company, Prudential Plaza, Chicago 1, Illinois.

Thor
PORTABLE POWER
TOOLS

THOR POWER TOOL COMPANY, CHICAGO

Atlanta • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit • Houston • Indianapolis • Kansas City, Mo. • Los Angeles • Milwaukee • Newark • Long Island City, N. Y. • Philadelphia • Pittsburgh • Richmond • St. Louis • San Francisco • Seattle • Toronto, Canada • Export Division, New York City

To spot what's NEW and best for you

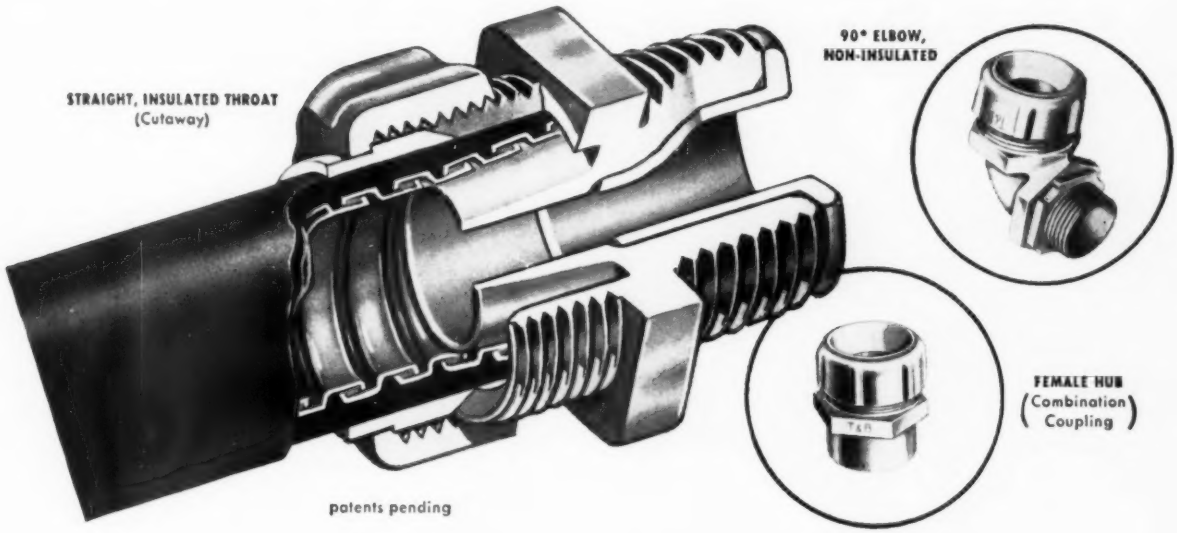
call GraybaR first for . . .

GraybaR Everything Electrical GraybaR Electric Company

ONLY T&B CONNECTORS

*for flexible liquid-tight conduit**

OFFER ALL THESE ADVANTAGES



patents pending

THE T&B LINE provides a size range of ⅜" to 4" in the straight, 45° and 90° angle types . . . both insulated and non-insulated.

THE T&B LINE includes combination couplings from ⅜" to 1¼".

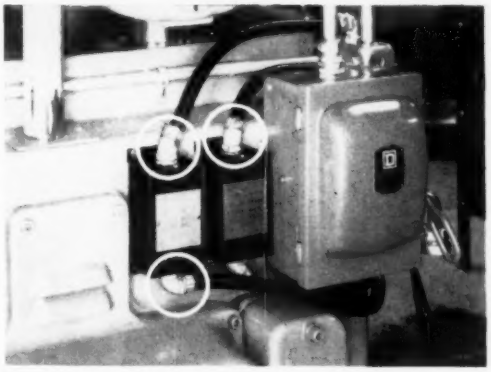
A T&B Liquid-Tight connection can't be half safe. The mechanical strength, continuity of ground, and oil seal are all interdependent. Each gives positive assurance that you have all three. And T&B's more compact design means easier installation and improved appearance.

Your T&B distributor has this complete line in stock. Be sure to ask for a demonstration . . . or write direct to T&B for detailed specifications.

* *Sealtight or equivalent*

THE T&B INSULATED LINE complies with all codes:

The National Electric Code (Paragraph 3736b)
J.I.C. Standards (Paragraphs 22.1.7 and 22.2.2)
Machine Tool Electrical Standards (Paragraph 22.1.7)



LOOK FOR THIS SIGN — AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED **T&B** DISTRIBUTOR

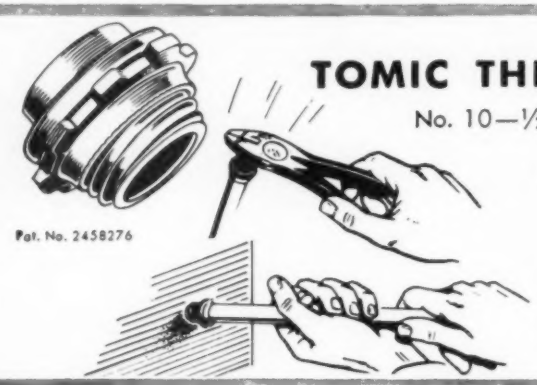
The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

THE THOMAS & BETTS CO.

INCORPORATED
34 BUTLER STREET, ELIZABETH 1, NEW JERSEY
THOMAS & BETTS, LTD., MONTREAL, P. Q., CANADA
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

To spot what's NEW and best for you
call GraybaR first for . . .
GraybaR Everything Electrical GraybaR

Do the Job
BETTER, EASIER, FASTER with
TOMIC FITTINGS



TOMIC THINWALL CONNECTORS

No. 10—½" · No. 11—¾" · No. 12—1"

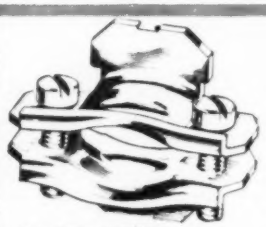
No crimp, no screw, no wrench . . .
Just tap or push it on

Interior stainless steel washer holds tubing securely—makes uniform, safe, permanent vibration-proof 6-point ground around entire tube. OK in concrete slabs. Smooth raceway. Perfect for cramped or corner locations.

TOMIC THINWALL COUPLINGS

No. 310—½"
No. 311—¾" • No. 312—1"

Screws in on straightaway jobs . . . snaps in on corner jobs. No tools needed. Cannot shake loose. Versatile . . . change from heavy pipe to Thinwall and vice versa. Can be used to go from Thinwall to Greenfield. Easy to install. Easy to inspect.



TOMIC CABLE CONNECTORS

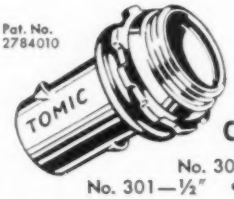
No. 100 Romex Connector for ½" K.O.

No. 200 Service Entrance and Range Cable Connector for ¾" K.O.

Installed from the outside of the box with no locknuts to lose or fumble with. Fits in quickly and easily Handles new and old type non-metallic sheathed cable Makes the job easier, safer, better.

TOMIC 2 in 1 BOX HOLDER or FIXTURE HOLDER

For concrete work—prevents lost boxes, eliminates shifting, keeps box clean . . . all but centering clamp reclaimable, hangers can be used again and again. Used as a fixture hanger, it's quickly and easily installed on deck—has ample thread allowance for all conditions. Provides fixture mounting studs away from outlet boxes.



TOMIC TWIST-IN FLEXIBLE STEEL CONDUIT CONNECTORS

No. 300—¾"
No. 301—½" • No. 302—¾"

Just twist it in—that's all! Twists inside flexible conduit. Assures positive ground. Smooth interior and rounded throat. All steel construction. Will not shake loose.

IMMEDIATE DELIVERY—WRITE FOR SAMPLES

TOMIC SALES & ENGINEERING CO.

ORIGINATORS and Manufacturers of Cable, Tap-On and Twist-In Fittings

20,000 Sherwood Ave. • Detroit 34, Michigan

To spot what's NEW and best for you

call GraybaR first for . . .

Everything Electrical GraybaR

Thread Conduit Faster with TOLEDO Tools

If It Bears The TOLEDO Label
You Know It's a Dependable Product

(A) The No. 68 Power Drive is the ideal, lightweight portable power drive. Adaptable wherever power is needed for threading, pulling, lifting, cranking, turning. Takes die stocks up to 4". Powered by reversible ½ HP A.C. motor or 90 psi air motor.

(B) TOLEDO'S Heavy-Duty Drop-Forged Aluminum Pipe Wrenches have the strength of steel at half the weight. Featuring drop-forged aluminum hook, housing and handle and alloy steel jaw, nut and spring, these wrenches are unconditionally guaranteed. Jaws are easily replaced. Steel hook jaws available on 24" and 36" sizes, while non-sparking type can be used for hazardous conditions. All popular sizes from 10" to 36".

(C) Unconditionally guaranteed! TOLEDO Heavy-Duty Malleable Wrenches are built for hard, rugged service. Both jaws are hardened steel and the hook jaw is the finest grade of drop forging. You'll like the spin-easy nut and single flat spring that assures quicker, easier setting of jaws. Complete range of sizes from 6" to 48".

(D) TOLEDO Ratchet Pipe Threaders produce clean-cut, perfect threads—ideal for bench work and close corner jobs. Instant die change. Capacity ⅛" to 2" with a choice of die heads for pipe or conduit.

(E) TOLEDO Ratchet Pipe Reamers are designed for faster, easier reaming without gouging. Chips are removed better. Easily-resharpened replacement heads available at low cost. From ⅛" to 3" in two models for hand or power.

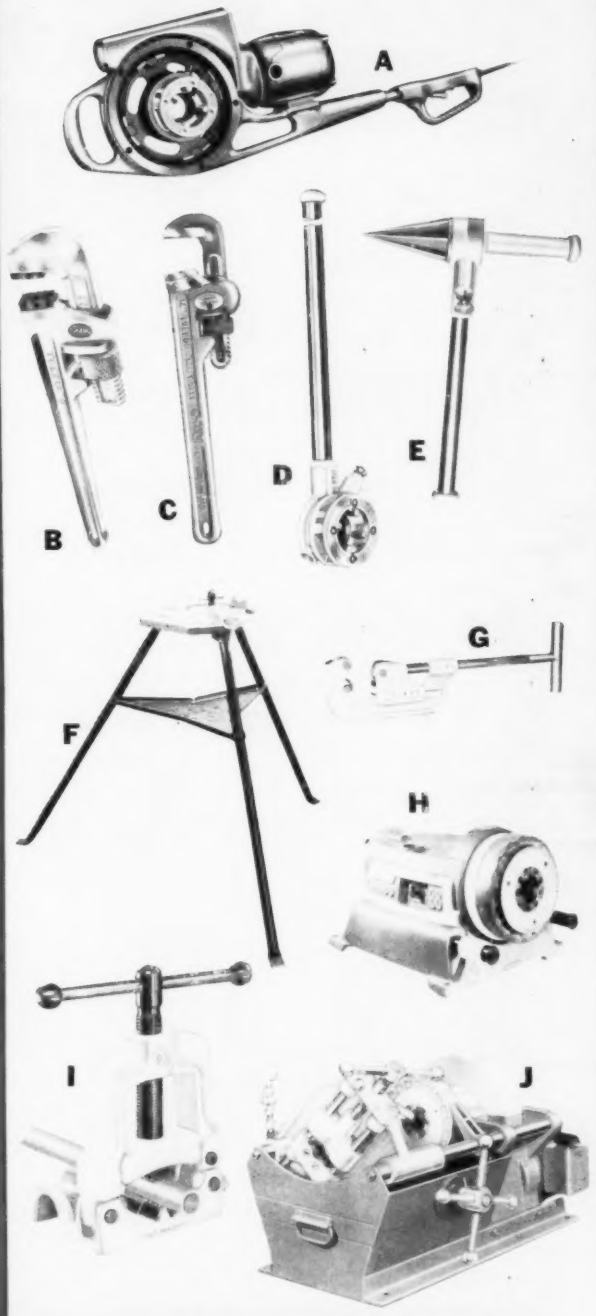
(F) TOLEDO'S No. 8A Vise Stand sets up quickly and easily—won't fold when in use. Can be used with most popular-make vises. Its heavy gauge steel tray, rubber foot pads and many other features add up to typical TOLEDO high quality.

(G) TOLEDO Heavy Duty pipe cutters feature strong, malleable frames designed to give the operator an easy hand grip while putting the cutter on the pipe or conduit. Two rollers in the frame make it easier to hook the cutter on the pipe. This quality tool handles ⅛" to 2".

(H) TOLEDO No. 88 High Speed Power Drive is a portable power unit that converts hand tools to swift, efficient power tools. Grips conduit firmly and accurately .

(I) TOLEDO'S No. 22 Vise gives you high quality at low cost. Acme threads mean faster action, while interchangeable jaws, quick-mounting yoke and non-slip pipe benders are guaranteed to give satisfaction. Capacity ⅛" to 2½". The ⅛" to 4½" capacity no. 25 Vise has five jaws for the most positive and equalized grip possible.

(J) TOLEDO No. 999 Portable Power Machine cuts, threads and reams conduit up to 2". Unusually high production with instant die change. Cutting—choice of knife or wheel cut-off. Threading—separate quick opening die heads and dies for each size. Reaming—quick and smooth by a 6-tooth cone-type fluted reamer.



Quality Checked

TOLEDO®

THE TOLEDO PIPE THREADING MACHINE CO.
TOLEDO 4, OHIO

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

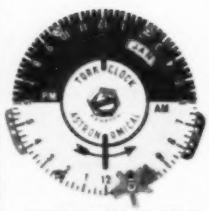
TORK
time switches

TORK's COMPLETE LINE answers ALL of your TIME SWITCH problems

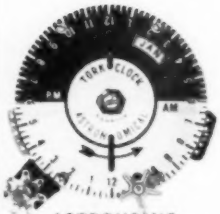
PLAIN DIAL
Same on-off time daily

SKIP-A-DAY DIAL
Same on-off time daily — skips selected days

SEVEN DAY DIAL
Different on-off time each day — skips selected days



ASTRONOMIC DIAL
Sunset on — Selected time or Sunrise off



ASTRONOMIC SKIP-A-DAY
Sunset on — Selected time or Sunrise off — Skips selected days

AVAILABLE IN SP, DP, 3P, SPDT, DPDT, 2 CIRCUIT AND MOMENTARY CONTACT SWITCHING

TORK'S *complete line* provides the widest *practical* variety of timing dials with rugged switches and all-purpose enclosures to meet any on-off control application. In the simplest or most complex automatic installation, TORK is best suited for your specific requirements.

TORK

TIME CONTROLS, INC.
MOUNT VERNON, NEW YORK

Write Dept. G-10 for complete catalog

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

TRIANGLE

IT MUST BE RIGHT! ®

YOUR GUARANTEE OF QUALITY

TRIANGLE

IT MUST BE RIGHT! ®

TRIANGLE MAKES *MANY* TYPES TO *ONE* STANDARD...

AIRPORT LIGHTING CABLE
CAA Specification L-824.

APPLIANCE WIRE
Thermoplastic, U/L.

ARMORED CABLE
Type ACT, U/L.

ARMORED LEAD CABLE
Type ACL, U/L.

BUILDING WIRE
All Types, U/L.

CATHODIC PROTECTION CABLE
Polyethylene Insulation, PVC Sheath.

CONDUIT
U/L. Rigid Steel, Hot-Dipped Galvanized or Black Enameled; Flexible Steel, Hot-Dipped Galvanized; EMT, Electro-Galvanized.

CONTROL CABLES
IPCEA. Rubber, Thermoplastic or VC Insulation; Braid, Neoprene, Thermoplastic or Lead Sheath.

FIXTURE WIRE
All Types. U/L.

SUBMERSIBLE PUMP CABLE
Rubber Insulation, Neoprene Sheath.

WEATHERPROOF LINE WIRE
Neoprene or Polyethylene Type.

NON-METALLIC SHEATHED CABLES
Types NM, NMC-UF, U/L.

PARKWAY CABLES
IPCEA. Rubber or VC Insulation; Lead or Neoprene Sheath; Flat, Plain steel, galvanized, or steel armor.

POWER CABLES
IPCEA. Rubber, VC, or Asbestos and VC Insulation; Braid, Neoprene, Lead Sheath or Interlocked Armor.

SERIES STREET LIGHTING CABLE
IPCEA. Rubber or Thermoplastic Insulation; Neoprene, Thermoplastic or Lead Sheath.

SERVICE CABLES
Service Entrance, Type SE Styles A, U. Type USE, Style RR Service Drop Type SD, Style SDC. Self-Supporting Service Drop: Neoprene or Polyethylene Insulation; Rubber Insulation, Neoprene Sheath.

TREE WIRE
Rubber Insulated, Neoprene Sheath.

IT MUST BE RIGHT!

It Must Be Right
The Trade Mark of TOP Quality
TRIANGLE ®

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, N. J.

Manufacturers of Arteries for Electricity, Liquids and Gases

WIRE • CABLE • CONDUIT • PLASTIC PIPE • BRASS AND COPPER TUBE

To spot what's NEW and best for you

call GraybaR first for...

GRAYBAR Everything Electrical GraybaR

UTICA

over 170 different pliers from stock

the right tool means a better job

That's why Utica offers such a broad range of standard tools—hundreds of pliers, wrenches and other hand tools direct from stock. And to keep pace, Utica is continually developing special and custom tools for the changing needs of industry. If your operation should suddenly call for a special plier or wrench, confer with your Utica Distributor. Counseling on the use and development of new and special tools is a regular part of his business.

Utica Drop Forge & Tool Division, Kelsey-Hayes Co., Utica 4, N.Y.

USE **UTICA** *...the tools the experts use!*

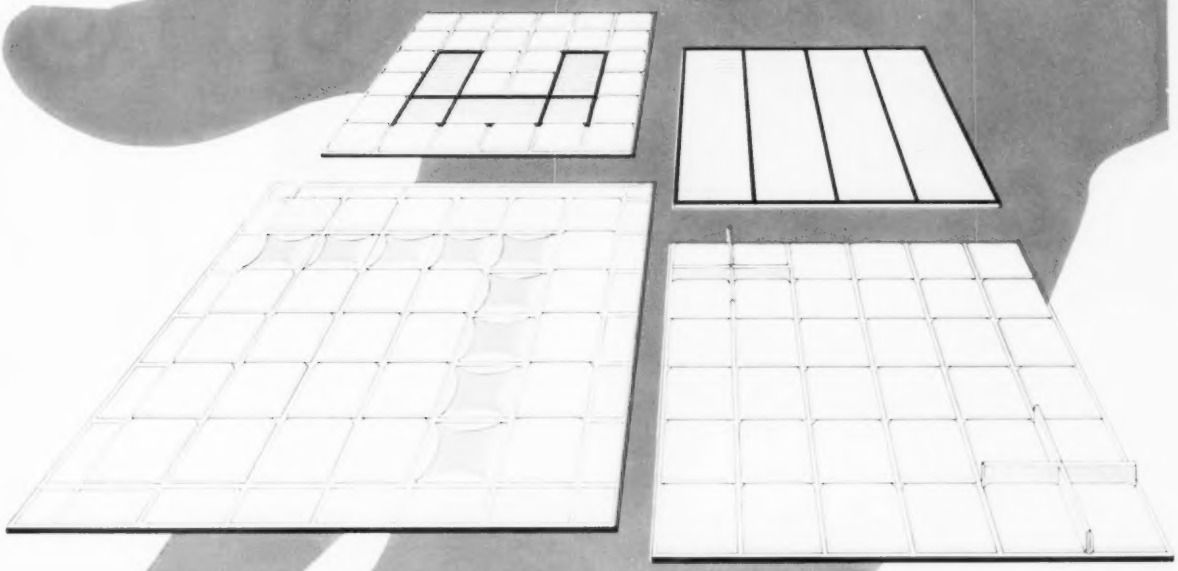
Hallmark of Quality since 1895 U TI CA® UTICA DROP FORGE & TOOL DIVISION • KELSEY-HAYES CO., UTICA 4, NEW YORK

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

In the palm of your hand



an infinite variety of ceiling designs which can be laid out, bill-of-materialed and priced right in the field

No need to send blueprints to the factory to be worked up into drawings and bills of material. You can create your design on graph paper and any of our district offices in the U. S. or Canada will then quickly bill-of-material and price it for you.

You work from standard, in-stock components—grids, channels, diffusers, louvers, baffles, color filters, etc.,—fully illustrated and described in our new catalog. Even an installation kit is provided, including a simple crimping tool with which most of the installing can be done.

The design possibilities are limitless. Diffusers are in various styles, sizes, patterns, textures and plastic materials. Color can be obtained through inexpensive color filters. Even colored baffles can be used. *Wakefield Ceiling '58 is spectacular proof that Wakefield is on the march. Watch Wakefield in '58!*

WAKEFIELD CEILING '58

Catalog describes and illustrates Wakefield Ceiling '58 in detail and lists district offices in U. S. and Canada.

OFFICES IN 43 PRINCIPAL CITIES IN THE U. S. AND CANADA

WAKEFIELD

THE WAKEFIELD COMPANY • VERMILION, OHIO

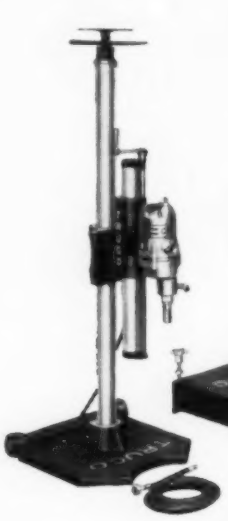
WAKEFIELD LIGHTING LIMITED • LONDON, ONTARIO

To spot what's NEW and best for you

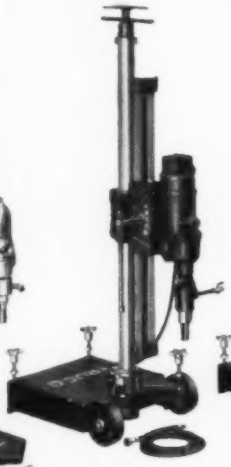
call GraybaR first for...

GRAYBAR Everything Electrical GraybaR

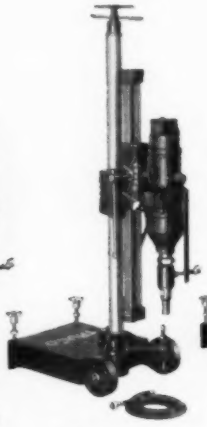
Truco Hand-Swivel Drill Motor mounted in Truco Drill Stand for drilling holes 1" through 3½" O.D. in vertical or horizontal positions with machine anchored to wall.



Model A Truco Diamond Drilling Machine; 1000 rpm motor. For drilling holes 1" through 5" O.D.

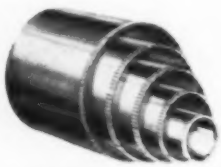


Model B Truco Diamond Drilling Machine; 750 rpm motor. For drilling holes 1" through 6¼" O.D. **Model C** Truco Diamond Drilling Machine; 350 rpm motor. For drilling holes 3" through 9" O.D.



Model D Truco Diamond Drilling Machine; 78 rpm motor. For drilling holes 7" through 14" O.D.

Model E Truco Diamond Drilling Machine; 300 rpm air motor. For drilling holes 5" through 14" O.D. **Model F**; 475 rpm, for drilling holes 3" through 10" O.D.



TRUCO SWIVEL DIAMOND BITS

Available in standard sizes from ⅛" to 14" O.D. Standard Lengths are 4½" and 12". Custom Bits available in lengths and O.D.s other than those listed.

TRUCO DRILL MOTOR and SWIVEL KIT

Heavy duty 2500 rpm drill motor; integral Water Swivel attached; complete in carrying case—weighs 17½ lbs. Drills holes up to 1⅝" in all masonry except where reinforcing bars may be encountered. Excellent for anchor holes.

TRUCO PORTABLE DIAMOND DRILLING MACHINES and EQUIPMENT

1. Each machine designed for universal application within the range of the bit sizes it will handle.
2. All machines designed for use with 110 V current, 60 cycles or less.
3. Smooth, clean holes cut quickly, quietly and with pin-point accuracy. Eliminates hammer and chisel work, noise, dust, break-out around edges, follow-up patching and big clean-up job.
4. Can save its cost in a single day's use in air conditioning, plumbing, tile setting, electrical maintenance, utilities work.
5. Pivot permits drilling at any angle through 360°.
6. Telescopic post locks unit between floor and ceiling or between walls for rigidity. Column slide bracket locks on post at any point, gives complete vertical adjustability.
7. Easy one-man drilling in any location because machine is demountable and easy to set up and operate.

Truco Swivel Division

WHEEL TRUEING TOOL CO.

35-3200 W. Davison Ave., Detroit 38, Michigan

To spot what's NEW and best for you

call GraybaR first for...

GraybaR Everything Electrical GraybaR Electric Company

FOR

QUALITY

PRECISION THREADED, TOUGH
PERFECTLY FINISHED THIN WALL

EMT

CONDUIT

FITTINGS

•

See or phone your

GRAYBAR SOURCE

•

Specify WAGNER

and get every desirable working feature

•

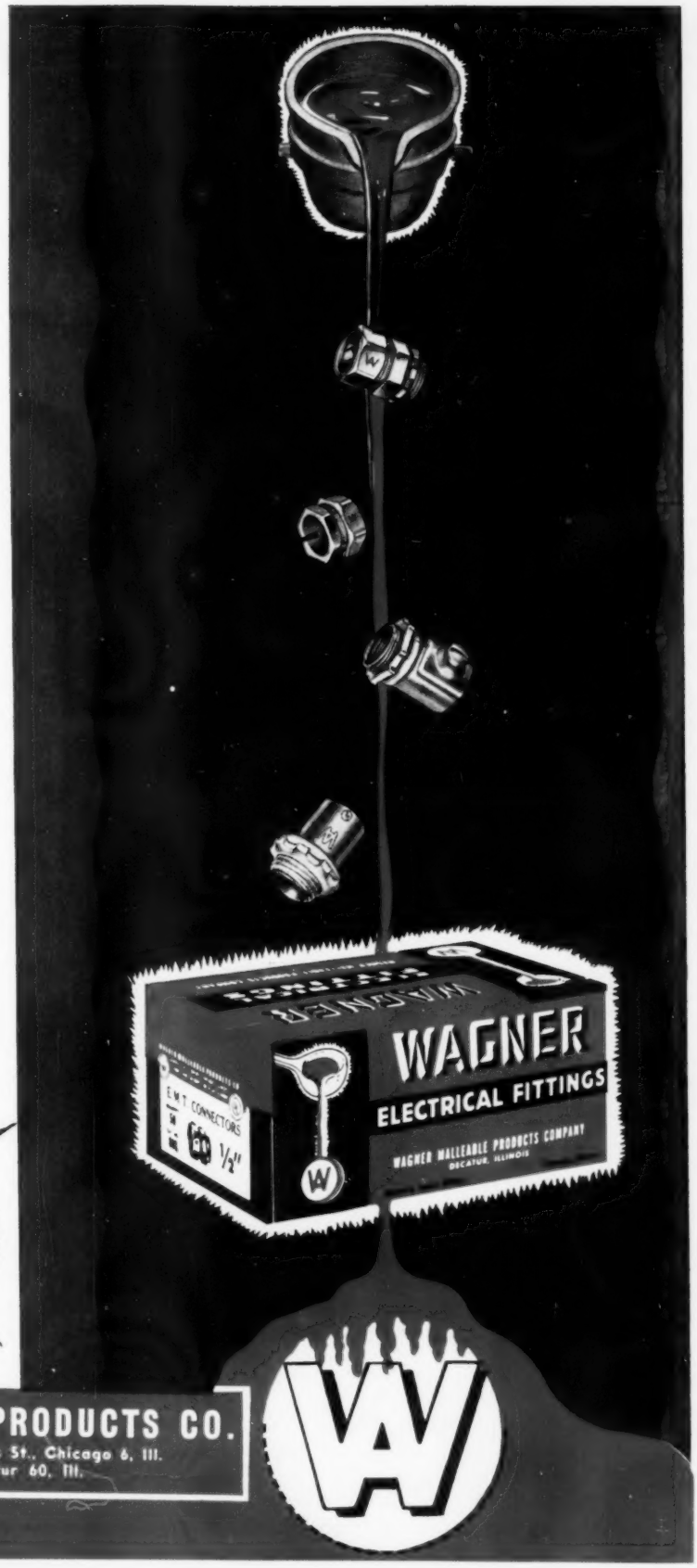
COMPRESSION
SET SCREW
INDENTER

FITTINGS

available in all types and sizes

•

EACH WAGNER CARTON IS LABELED FOR COMPLETE AND QUICK IDENTIFICATION



WAGNER MALLEABLE PRODUCTS CO.

General Sales Office: 222 W. Adams St., Chicago 6, Ill.
Foundry and Plant: Decatur 60, Ill.

To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

AMAZON TAPE

Amazon A.S.T.M. tapes are designed for the severest kind of service — where top quality is of prime importance.

AMAZON FRICTION TAPE is of unusually high and uniform quality. Meets Government Specification HH-T-101 Grade A. The long fibers of the rubber compound used afford superior adhesion and make the tape an excellent insulator.

AMAZON RUBBER TAPE withstands a dielectric test of at least 350 volts per mil of thickness . . . meets Government Specification JJ-T-11C. The very high natural rubber content of this tape makes it extremely elastic and it is self-vulcanizing into a solid waterproof joint.

There's a Graybar tape
FOR EVERY JOB

Tapes for every electrical requirement are conveniently available from your nearby Graybar office or warehouse. Made to rigid Graybar specifications these fine tapes have a record of superior performance, long service, and outstanding value. For over forty years they have been the choice of industry and careful workers everywhere. Check the types shown on this page and see which are best suited to your own particular needs.

VICTOR TAPE

for general commercial use requiring a high grade tape

VICTOR FRICTION TAPE has a strong tacky friction, ages well and is virtually free from pinholes. Careful inspection assures a uniform quality.

VICTOR RUBBER TAPE is second in quality only to Amazon. It withstands dielectric test of 300 volts per mil of thickness — gives excellent service both indoors and out.

STICKA FRICTION TAPE

STICKA will be your choice for a hundred and one everyday jobs where a thoroughly reliable and economical tape is indicated. Order it by the 60 foot roll or in the convenient ten-roll shop package.

514-44

DEPEND ON ALL **Graybar** TAPES FOR THE BEST IN SERVICE AND VALUE!

FREE! **SAMPLE TAPE ROLLS—Graybar will be glad to mail you sample rolls of Amazon Rubber Tape and Sticka Friction Tape. Each roll contains 30 feet of tape—enough for an on-the-job trial. Write for them today!**

To spot what's NEW and best for you

call GraybaR first for . . .

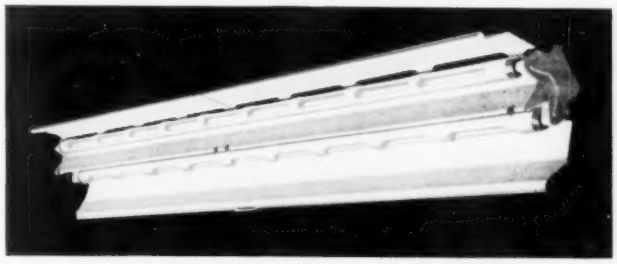
Everything Electrical GraybaR ELECTRIC COMPANY

Suspended 30 feet above the playing court of the Boston Badminton and Tennis Club are two rows of Wheeler Power-Lume fixtures with G. E. Power-Groove lamps. Beneath this new indoor sportslighting development, players (above) open a match in bright, glarefree, shadowless light. Completing the ideal lighting situation, club members note no discernible stroboscopic or "flicker" effect when they or the ball are in motion. Footcandle level runs from 35 at net to 30 at baselines.

A SPORTS LIGHTING FIRST— WITH WHEELER POWER-LUME FLUORESCENT FIXTURES

Boston Badminton and Tennis Club's recently relighted court represents a major breakthrough in indoor sportslighting as newly developed Wheeler Power-Lume fixtures with Power-Groove lamps are installed. Lamp grooves are positioned downward at an angle of 50° from the vertical for the primary purpose of obtaining excellent flat-bottomed candlepower distribution. This eliminates undue concentration of light directly below fixtures. The result is much less glare and no "flicker", with a minimum number of rows required for uniform illumination over a given area.

Power-Lume by Wheeler — America's most versatile new fixture in 2 types of construction, "F" and "V" . . . specifically designed to utilize fully the extra illuminating power of the new Power-



Groove lamps. Delivers *twice* the amount of lumen output per foot of lamp length. For complete details, write for New Product Data Sheet No. 100 D.

Wheeler REFLECTOR COMPANY

(Division of Franklin Research Corp.)
275 Congress Street, Boston 10, Mass.
Distributed Exclusively Through Electrical Wholesalers

To spot what's NEW and best for you

call GraybaR first for . . .

GraybaR Everything Electrical GraybaR Electric Company

Two portables with

WIDE RANGE COVERAGE

Traditional Weston quality alone would keep these famous model 904 portable instruments *'way in the lead.* But their exceptionally broad range coverage, plus other exclusive features which distinguish this comprehensive instrument line such as . . . unequalled scale visibility . . . wrap-around windows . . . hand calibrated mirror scales and knife-edged pointers . . . convenient terminal locations . . . efficient shielding . . . rated accuracy of 0.5% . . . make them *standouts* for laboratory or shop portable needs. Other instruments in this broad line include D-C Voltmeters, Volt-Ammeters, Ammeters, Milliammeters; A-C Voltmeters, Ammeters, Milliammeters; and A-C and D-C single-phase Wattmeters. For complete information see your local Weston representative or write for literature . . . WESTON INSTRUMENTS, Division of DAYSTROM, Inc., 614 Frelinghuysen Avenue, Newark 12, New Jersey.

A DAYSTROM UNIT

WESTON *Instruments*

To spot what's NEW and best for you

call GraybaR first for . . .

GRAYBAR Everything Electrical GraybaR ELECTRIC COMPANY

Ask your distributor for

Youngstown Buckeye Full

Weight Rigid Steel Conduit

and

Youngstown Electrical

Metallic Tubing.

When the new addition and remodeling of Employers Mutual Casualty Company's existing office building in Des Moines, Iowa, was planned, Youngstown's "Buckeye" Full-Weight Rigid Steel Conduit was wisely specified to provide life-time positive, safe protection for the electrical wiring system.

If safe and efficient functioning of **your** electrical systems—in any location, under any condition—presents a problem, then Youngstown "Buckeye" Conduit should be specified. Satisfied users across the nation report to us: "It's much easier to bend and thread—wire fishing is less troublesome—and because its corrosion resistance is superior, we get a much longer service life."

"Buckeye" Conduit is fast becoming the specification of leading building owners, architects and contractors—why not make it yours?

Delivering is no problem—as all the better distributors in electrical and industrial markets carry complete and ample stocks. Their quick, courteous service is yours for a phone call, anytime.

YOUNGSTOWN "BUCKEYE" CONDUIT

. . . provides permanent wiring protection for remodeled Iowa building

Employers Mutual Casualty Co. Bldg., Des Moines, Iowa
Architects & Engineers: Childs & Smith, Chicago, Ill.
General Contractor: Weitz Construction Co., Des Moines, Iowa
Electrical Contractor: Weston Lighting Co., Des Moines, Iowa

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon, Alloy and Yoloy Steel
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

Standard-threaded rigid steel conduit is the only wiring system approved today by the National Electrical Code as moisture-, vapor-, dust- and explosion-proof for use in hazardous locations and occupancies.

To spot what's NEW and best for you

call GraybaR first for . . .

Everything Electrical GraybaR

Rapid growth of Graybar's counter service shows how electrical contractors and plant men make use of the wide knowledge of Graybar Countermen and appreciate the interest in their needs. Use the counter service of your nearest Graybar location to speed up your delivery of job-needed supplies and equipment.

GraybaR
ELECTRIC COMPANY
EMPLOYEE OWNED

For fast service on the newest and best Electrical Supplies for every Construction and Maintenance need

Call your nearest Graybar office

Every Graybar office listed below wants your business. And the office nearest you will make your specific need its prime concern. Since Graybar is wholly owned by its operating and retired personnel, we are in business for ourselves. And, we know that our continued growth depends upon serving you well.

ALABAMA
Birmingham
Huntsville
Mobile

ARIZONA
Phoenix

ARKANSAS
Little Rock

CALIFORNIA
Fresno
Long Beach
Los Angeles
Oakland
Oceanside
Sacramento
San Bernardino
San Diego
San Francisco
Santa Ana
Van Nuys

COLORADO
Colorado Springs
Denver

CONNECTICUT
West Hartford
New Haven

DELAWARE
Wilmington

DISTRICT OF COLUMBIA
Washington

FLORIDA
Fort Lauderdale
Jacksonville
Miami
Orlando
St. Petersburg
Tampa
West Palm Beach

GEORGIA
Atlanta
Columbus
Savannah

IDAHO
Boise

ILLINOIS
Chicago
Peoria
Springfield

INDIANA
Evansville
Hammond
Indianapolis

IOWA
Davenport
Des Moines
Sioux City

KANSAS
Wichita

KENTUCKY
Lexington
Louisville

LOUISIANA
Baton Rouge
Lake Charles
New Orleans
Shreveport

MAINE
Portland

MARYLAND
Baltimore

MASSACHUSETTS
Boston
Springfield
Worcester

MICHIGAN
Detroit
Flint
Grand Rapids
Lansing

MINNESOTA
Duluth
Minneapolis
St. Paul

MISSISSIPPI
Jackson

MISSOURI
Kansas City
St. Louis
Springfield

MONTANA
Butte

NEBRASKA
Omaha

NEW HAMPSHIRE
Manchester

NEW JERSEY
Newark
New Brunswick

NEW YORK
Albany
Binghamton
Buffalo
New York City
Roosevelt Field
Rochester
Syracuse

NORTH CAROLINA
Asheville
Charlotte
Durham
Rocky Mount
Winston-Salem

OHIO
Akron
Cincinnati
Cleveland
Columbus
Dayton
Portsmouth
Toledo
Youngstown

OKLAHOMA
Oklahoma City
Tulsa

OREGON
Eugene
Portland

PENNSYLVANIA
Allentown
Erie
Greensburg
Harrisburg
Philadelphia
Pittsburgh
Reading

RHODE ISLAND
Providence

SOUTH CAROLINA
Columbia
Greenville

SOUTH DAKOTA
Sioux Falls

TENNESSEE
Bristol
Chattanooga
Knoxville
Memphis
Nashville

TEXAS
Abilene
Amarillo
Arlington
Austin
Beaumont
Corpus Christi
Dallas
El Paso
Fort Worth
Houston
Lubbock
San Antonio

UTAH
Salt Lake City

VERMONT
Rutland

VIRGINIA
Norfolk
Richmond
Roanoke

WASHINGTON
Seattle
Spokane
Tacoma

WEST VIRGINIA
Charleston

WISCONSIN
Green Bay
Madison
Milwaukee

Through more than 130 offices, Graybar distributes over 100,000 electrical items

Headquarters: GRAYBAR ELECTRIC COMPANY, INC., 420 Lexington Avenue, New York 17, N. Y.

To spot what's NEW and best for you

call **GraybaR** *first for . . .*

GraybaR Everything Electrical GraybaR ELECTRIC COMPANY

Printed Form Speeds Panel Installation

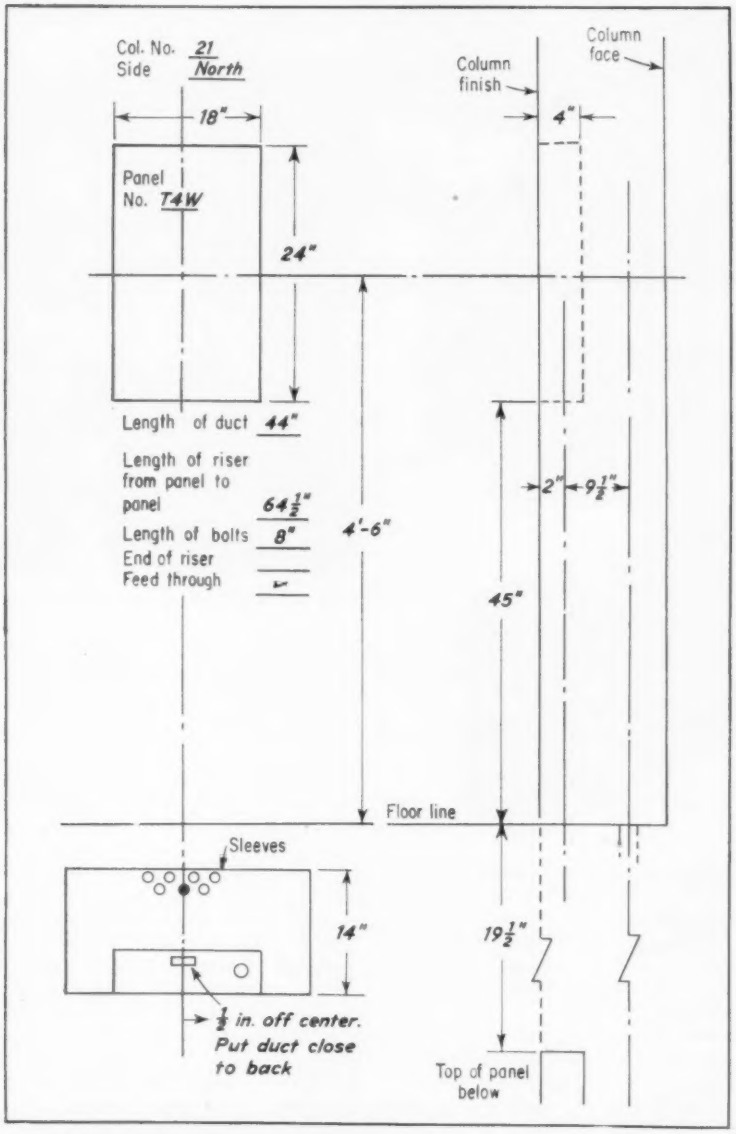
INSTALLATION

The great many power and lighting panels to be installed in the new office building of the Seaboard Air Ways Railway Co. in Richmond, Va., prompted Skippy Redford, job superintendent for Union Electric Co., Inc., Richmond, to devise a standard printed form which could be filled in to give complete instructions for preparing riser conduit to feed the panels.

Although all panels were to be installed on columns at a given distance from the floor, conduit configurations varied due to slight differences in floor-to-floor ceiling heights, existence of water pipes inside columns, variations in locations of sleeves through floors, etc., so that on-the-spot measurements had to be taken before conduit could be cut and bent. Panels also fed home runs to underfloor duct, which had to be cut to fit.

To avoid errors which usually crop up when measurements are jotted down on any handy scrap of paper, these printed forms were used to record all essential information. Panel locations were measured and data recorded on the forms. These forms, identified by column and panel numbers, were then given to the workmen at the conduit bending location, where the actual cutting, threading and bending were accomplished.

FEED-THROUGH PANEL mounted in column with underfloor raceway home run in place. Where offsets were required in conduit between panels on successive floors, such information was noted on printed forms and conduit was prepared in two sections joined by coupling. This made it possible to pass conduit through floor sleeve and adjust for minor differences in length due to the offsets.



PANEL INSTALLATION form included sketch of panel on column together with all information necessary to size riser conduit and underfloor duct. Additional notes were added where necessary to describe conditions other than standard. Sleeve through which riser was to come was blacked in.

Storage Rack For Active Blueprints

METHOD

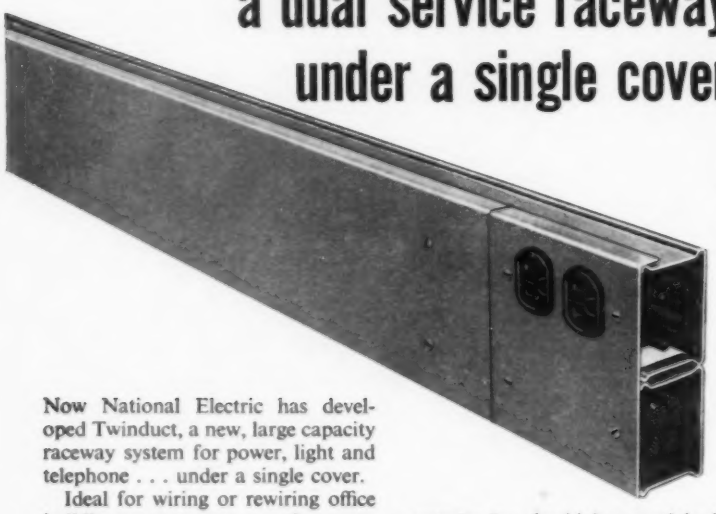
A simple and handy method for keeping active job blueprints in an engineering office has been developed by J. H. Blasdell, engineer and superintendent for Fisk Electric Company, Houston, Texas. The method consists of a clamp bar arrangement for holding all the prints together in each set and a rack assembly for neatly storing the prints.

A pair of flat wood strips about 1-in. wide, ¼-in. thick and about 30 in. long are used as the clamp for the edge of the group of prints in each set. At about 4-in. intervals along each strip ⅜-in. carpet tacks are driven into the ¼-in. thickness. The pointed ends of the tacks protrude about an ⅛th of an inch along

for power
for light
for telephone

NEW TWINDUCT

a dual service raceway under a single cover



Now National Electric has developed Twinduct, a new, large capacity raceway system for power, light and telephone . . . under a single cover.

Ideal for wiring or rewiring office buildings, apartments or other commercial structures, Twinduct can be installed flush with the wall or on the surface. High and low potential services are easily accessible by simply removing a common cover.

An all-metal surface raceway, Twinduct has ½" and ¾" knockouts and mounting holes along the base. It is approved by Underwriters' Laboratories Inc. for high potential wire fill up to 10 No. 6 AWG Type TW conductors. The low potential raceway accommodates 50 twisted pair telephone wires or several 26 pair cables. Covers are available for telephone jacks.

Write for complete information on the new National Electric Twinduct raceway system today.

Listed by Underwriters' Laboratories, Inc.

National Electric Products

PITTSBURGH, PA.

2 Plants • 12 Warehouses • 41 Sales Offices

WOOD STRIPS with carpet tacks driven through them are used to clamp the left hand edge of all prints associated with a particular job.

STEEL CLAMPS are pushed on the ends of the two wood strips which grip the prints, with the tack heads taking a bite into the paper. The small steel clamps maintain pressure between the two strips, as shown here by Jack Blasdell, engineer for Fisk Electric Company, Houston, Texas.

one side of each wood strip. These protruding tack heads provide a bite into the edge of the pile of sheets making up a set of plans.

To use the clamp, the prints are laid out flat, with the sheets in proper order from top down and with the left hand edge of all sheets carefully lined up. One of the clamp strips is then placed under the left hand edge of the pile of prints, and the other strip on top of the edge. The two strips are pressed tightly together for the tack heads to take their bite in the paper. Then a small metal C-clamp is forced on each end of the two strips and pushed toward the paper to provide maximum pressure between the wood strips. Each of these small clamps is made

3 ways to cut costs in grinding–

–all power-built by Black & Decker!

Whether you must take the work to the tool or bring the tool to the work, Black & Decker gives you a choice of grinders to save time and money.

Powerful B&D Bench Grinders save steps—speed up jobs when strategically located about your shop. Smooth running B&D motors give more constant speed, regardless of load. Four models: 6″ to 10″ sizes.

Precise light-weight B&D Die Grinders deliver top quality work at high speeds whether shaping, burring or grinding. Handle as easily as a pencil. Vibrationless—perfectly balanced from one end to the other. Smooth operation—perfect for carbide bit use. In sizes #8, #12, #20.

Time saving B&D Portable Grinders go to the work where surfaces must be prepared for welding and finishing. Perfect for smoothing welds, snagging and grinding castings and countless other grinding, cleaning and buffing jobs. 2½″, 5″ and 6″ sizes available.

See them today in your shop. Mail coupon for a free demonstration or more information.

Leading Distributors Everywhere Sell

Black & Decker®

Quality Electric Tools—Power-built to set the pace

MAIL TODAY FOR FREE DEMONSTRATION

THE BLACK & DECKER MFG. CO., Dept. 1204, Towson 4, Md.
(In Canada: Brockville, Ontario)

☐ Please arrange a demonstration of your ..... grinder. I am also interested in the tool(s) checked below.

☐ Please send additional literature.

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

☐ Drills ☐ Scrugguns® ☐ Magnetic Drill Presses ☐ Sanders

SAVE Man-hours,

have correct 3-phase connections with the

KNOPP PHASE SEQUENCE INDICATOR

Push the button and see the Sequence 60–600 V.

No adjustments required for readings

You just clip on the Knopp Phase Sequence Indicator, push the safety button and you are sure whether the phase sequence is A-B-C or C-B-A.

This new model K-3 Knopp Phase Sequence Indicator, like the previous models, shows phase sequence by direction of disc rotation rather than by lamps. Gives correct indication regardless of voltage or circuit conditions without changing taps or dials. It protects equipment and assures properly connected polyphase wiring; all voltages between 60 and 600, 3 phase, 3 wire 25-60 cycles. May be used on frequencies up to 400 cycles on the higher voltages.

Light Weight, Compact, Small

It stands up under rough field use and gives accurate and reliable service. It is made by Knopp Inc., technical electric equipment manufacturers of 30 years' experience. This indicator has a laminated bakelite housing and no exposed metal parts. It is built for complete safety. Fully insulated clips can remain attached between tests as safety push button permits indication only when needed. Weighing but 21 oz., the Knopp Phase Sequence Indicator is small and easy to carry. Price $29.25; leather carrying case, $5.85 additional. Order this Improved Model K-3 today or write for complete description.

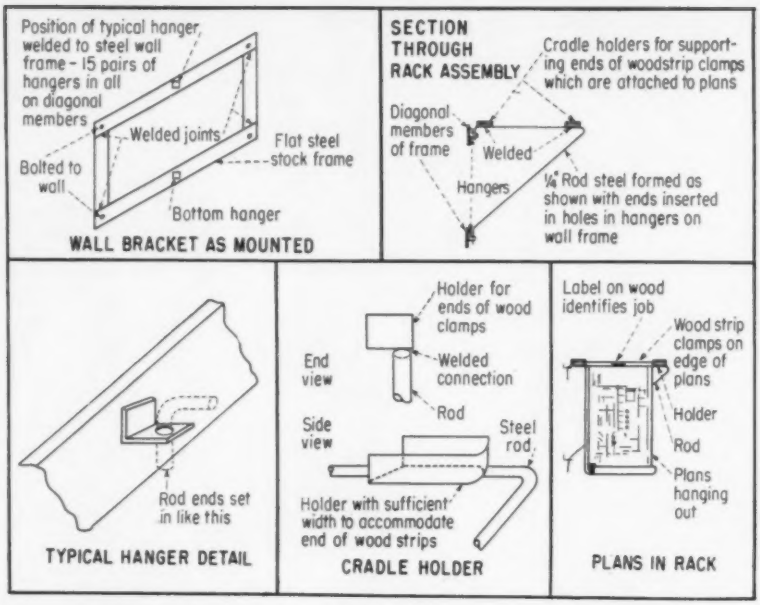
KNOPP Voltage Tester

For easier, safer, faster testing use the Knopp Voltage Tester. Gives magnitude of voltage between 110 and 600: a-c or d-c pure or rectified: 25 or 60 cycles. See your dealer or write for illustrated free, descriptive Bulletin No. 425.

KNOPP INC.

Founded in 1928 by Otto A. Knopp under the name of Electrical Facilities Inc.

Dept. A-3, 1307 66th St., Oakland 8, Calif.


Position of typical hanger welded to steel wall frame – 15 pairs of hangers in all on diagonal members
Welded joints
Flat steel stock frame
Bolted to wall
Bottom hanger
WALL BRACKET AS MOUNTED
SECTION THROUGH RACK ASSEMBLY
Cradle holders for supporting ends of woodstrip clamps which are attached to plans
Diagonal members of frame
Welded
Hangers
¼" Rod steel formed as shown with ends inserted in holes in hangers on wall frame
Rod ends set in like this
TYPICAL HANGER DETAIL
Holder for ends of wood clamps
End view
Welded connection
Rod
Side view
Steel rod
Holder with sufficient width to accommodate end of wood strips
CRADLE HOLDER
Label on wood identifies job
Wood strip clamps on edge of plans
Holder
Rod
Plans hanging out
PLANS IN RACK

CONSTRUCTION DETAILS of rack assembly show simplicity of arrangements.

OFFICE EFFICIENCY is greatly boosted due to easy removal and insertion of blueprints and ease of using prints which are maintained in the flat, rolled out position.

of steel strip about 1-in. wide and formed into an open square of the proper size to fit the two wood clamp strips. To provide ready identification of the prints when they are in the rack, a length of tape is placed on the upper side of the wood strip, as shown in the photograph. The job title is then printed on the tape and the plans are ready for the rack.

The rack itself can be seen in the photos. The basic support for the rack is a sturdy, wall mounted bracket of 2-in. flat steel stock, welded into a frame as shown in an accompanying sketch. This wall bracket supports 15 pivoting bar assemblies on which prints can be hung when they are held together by the wood strip clamp arrangement. Full details on the assembly of the rack are given in sketches.

This rack provides easy removal and insertion of the plans. When a particular set of plans is wanted, they can be readily identified by the tape label on the wood strip. Then all sets of plans in front of the wanted set is easily swung forward to permit easy removal. When the plans are to be returned to the rack, they can be easily inserted in their place by again swinging all other plans out of the way. The labels on all sets of plans can be easily read at all times because the labels are set at increasingly higher positions from front to back by reason of the diagonal members of the wall bracket.

Another advantage of this rack arrangement is that all plans are held in the rolled out position, making them much easier to refer to when they are taken off the rack.

In addition, the wooden strips do not mar desks and tables and tear other drawings as metal strips are likely to do. The plans lie flat on a table and do not have the annoying tendency of rolling themselves up if not held at both ends. Overall, the use of this type of rack for prints can add a great deal of efficiency to office engineering work. And when plans are no longer active they can be removed and stored elsewhere. The wood clamp strips can then be used on another set of plans and relabeled accordingly.

Fresher... by far!

CHASE TAPES

Daisies won't tell, but your work sheets will . . . Chase Friction, Rubber, Plastic and Neoprene Tapes stay fresher longer to give top taping performance. Every roll of Chase Tape is packaged in Saran Wrap* to *seal in* factory-freshness . . . *seal out* harmful moisture and prevent peeling, raveling or drying out. Result: perfect adhesive qualities in every roll you buy! Prove it for yourself . . . order a dozen rolls from your wholesaler.

**Trademark of The Dow Chemical Company for its vinylidene chlorine copolymer film.*

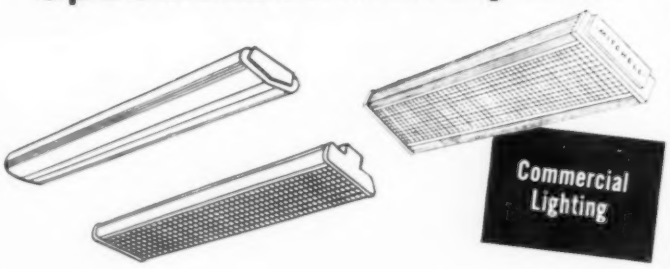
CHASE & SONS INC.
North Quincy, Massachusetts

CABLE INSULATING TAPE • CABLE BINDING TAPE
CABLE JACKET TAPE • NEOPRENE SPLICING TAPE
FRICTION, RUBBER AND PLASTIC TAPE
LAMINATED AND REINFORCED INSULATION

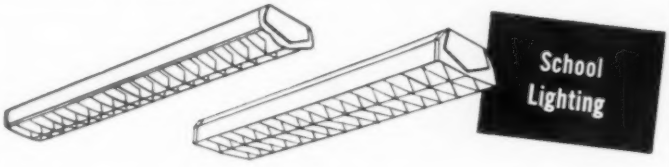
MITCHELL

The Most Dependable Name in Lighting!

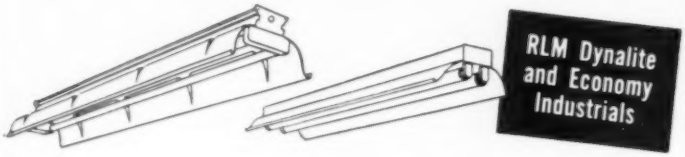
A Complete Line for Every Specification...Every Job!



Commercial Lighting

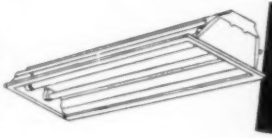


School Lighting

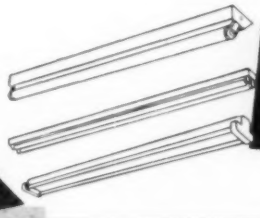


RLM Dynalite and Economy Industrials

Mitchell Lighting Company gives you the finest design and engineering in Fluorescent Lighting. Established more than 25 years ago Mitchell Lighting experience in design, engineering and manufacturing is your guarantee of quality lighting equipment made by a dependable organization.



EASIEST TO INSTALL *UNI-FLOW* Fluorescent Troffers



Fluorescent and Slimline Strips

MITCHELL

MITCHELL LIGHTING COMPANY

2263 W. St. Paul Avenue • Chicago 47, Illinois • U.S.A.

Low-Voltage Switching Provides Trucking Pick-Up Control

SIGNALS

The Touch-Plate Mfg. Corp. of Long Beach, Calif., has solved an irritating problem through the use of its own product by erecting in front of its plant a giant replica of the 12-circuit master control panel used with its remote-control switching equipment. The sign, just off the main highway, is a visual signal to truckers approaching the plant for pickups.

The company uses the large panel to notify each of the 12 truck transport concerns it uses whether or not it is necessary to stop to pick up a shipment. To the trucking companies, time is money; they run on schedules, and considerable time is

HIGHWAY SIGN (above) is giant replica of low-voltage master control panel in office (below). Lights in sign, turned on by pressing corresponding button of control panel, notify truckers of shipments to be picked up. Pilot lights behind switch buttons in office provide constant indication of lights illuminated on sign.

J. R. Fischer, Treasurer, discusses the financial viewpoint on "conservative design"

"It makes good sense for us to manufacture only the best ballasts at Sola"

It's my business to know, at any given moment, just what the financial picture is at Sola Electric Co. Even more important, however, is the need to know *why* the figures stand as they do.

The answer is simple — by superb engineering and efficient manufacturing we can produce a product of outstanding quality, yet so moderately priced that it keeps us in the black.

I know this policy pays off. Our sales have steadily increased yet we have had virtually no returns of our mercury ballasts under warranty.

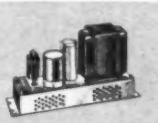
A Sola Constant Wattage Mercury Lamp Transformer, for example, proves the most economical in long-lasting, dependable service and in low operating cost. This is what we mean by Sola's conservative design. You can be sure you have the very best in transformers when you specify Sola — we can't afford to manufacture anything less.

Write for your copy of Bulletin MV-306

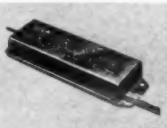
Sola Electric Co., 4633 W. 16th St., Chicago 50, Ill., BIshop 2-1414 • Offices in principal cities • In Canada, Sola Electric (Canada) Ltd., Canmotor Ave., Toronto 14, Ont.

SOLA

CONSTANT VOLTAGE TRANSFORMERS


REGULATED DC POWER SUPPLIES

MERCURY LAMP TRANSFORMERS


FLUORESCENT LAMP BALLASTS

Full skids for easy positioning

Convenient connection locations

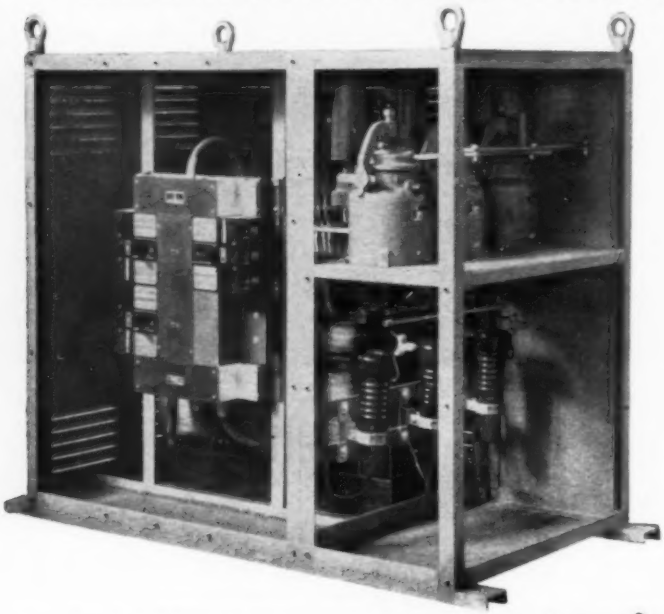
Fully removable panels

DB level below NEMA standards

Choice of components

LO-TEMP*

DISTRIBUTION UNI-CENTER



New Standard DISTRIBUTION UNI-CENTERS combine incoming line, transformer and outgoing feeder in one compact unit. The 112.5 KVA, three phase, 4160 to 280y/120 is just 63½" high, 74" long and 36" deep. The high voltage section is equipped with three 3 KV lightning arresters and gang operated, oil fused cutouts. The low voltage section has 3-pole, thermal magnetic case circuit breakers. The unit is shipped, handled and installed in one piece. The Standard DISTRIBUTION UNI-CENTER is available in any KVA rating and to and including 4800 V.

*Standard LO-TEMP transformers provide extra capacity at no extra cost.

LIVE BETTER ELECTRICALLY

Phone 2-1563

Standard Transformer CO.

WARREN, OHIO

"WHEREVER THERE IS POWER"

lost on dry runs. Nothing is more frustrating to a driver than to ease a heavy rig into a crowded factory yard, park it, and then have the shipping department say, "Sorry; nothing for you today."

Each of the 12 truck lines is assigned a light-button on the face of the double-sided panel. When there's a shipment to be picked up, a secretary simply touches the button on the actual master panel in the office which represents the truck line being paged. The corresponding light in the sign is immediately illuminated, providing a readily visible signal to the route driver. When his light is not on, he can go to his next stop without losing time.

Intercom Simplifies Conduit Work

COMMUNICATION

Union Electric Co., Inc., of Richmond, Va., makes effective use of a multiple-station intercom system to avoid delays in the preparation of conduit lengths for big jobs.

Power cutters, threaders and benders are set up on the ground floor at a central location which is connected by intercom to outlying areas on the same level or on upper floors as work progresses. Workmen installing conduit use the nearest station to call back to the central location, specifying the size and length of conduit required plus information on necessary bends. The prepared lengths are then delivered to the right spot by the helper or by use of a pulley and rope arrangement set up through any available air shaft.

The system also comes in handy for quickly locating the job superintendent, foreman, or other workers without the customary legwork.

CONDUIT SPECS are relayed from upper floors after measurement to central cutting-threading-bending location by intercom system.

News about

B.F.Goodrich Chemical *raw materials*

Control cable lasts longer with insulation of Geon

CABLE insulated and jacketed with Geon polyvinyl materials is lightweight, easy to install and splice. No braids to rot or wick moisture; no lead to corrode or be eaten away by electrolysis.

Insulation compounds of Geon are strong, weatherproof, keep their exceptional properties with age. They resist flame, will not support combustion, and have good flexing properties. They also resist oil, grease and chemicals.

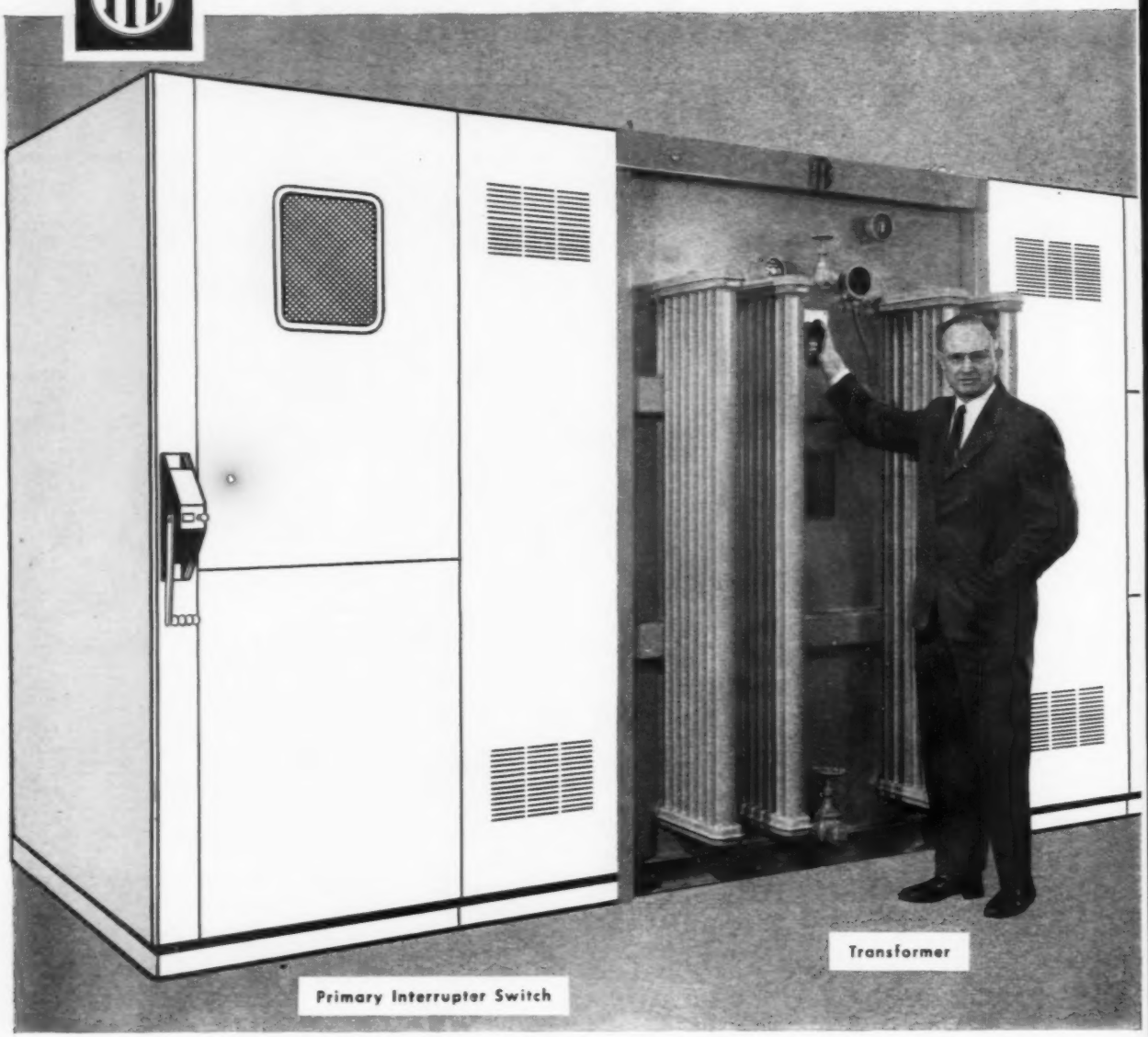
For information about Geon wire and cable covering, write Dept. LS-2, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

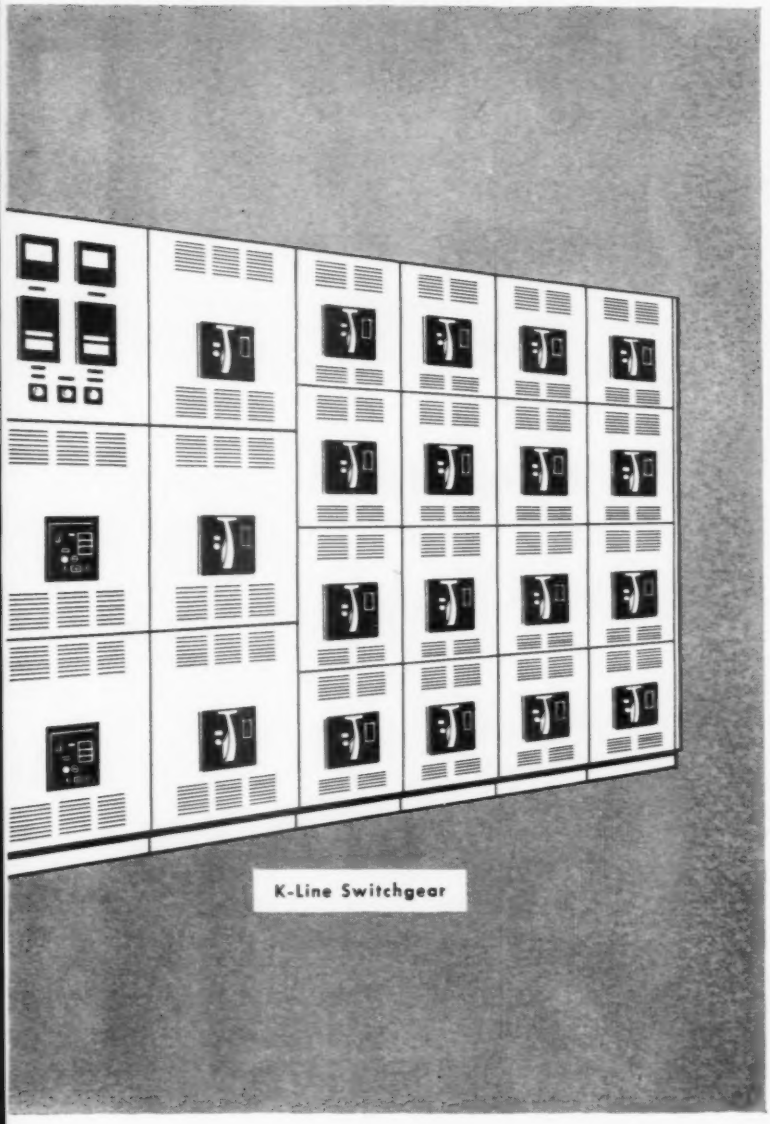
GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

SECONDARY UNIT SUBSTATIONS

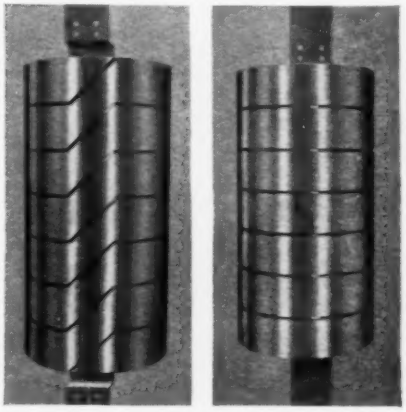


TRANSFORMERS BUILT ON FRESH IDEAS

New designs, incorporating latest ideas, insure more dependable performance, better looking units



Coils stay put. Double jackscrews in combination with tie rods between upper and lower core clamps hold coils rigidly in place, even under severest short circuit stress.



Brute strength secondaries. A fresh approach to high current secondaries for dry type transformers is this coil formed from solid copper bus. This unique design embodies great structural strength, and high conductivity.

Look what I-T-E gives you now in unit substations: transformers designed fresh from the ground up . . . incorporating developments based on the most up-to-the-minute transformer technology.

This fresh approach to transformer design and construction has produced remarkable new gains in transformer performance: greater dependability, stronger construction, more effective use of materials.

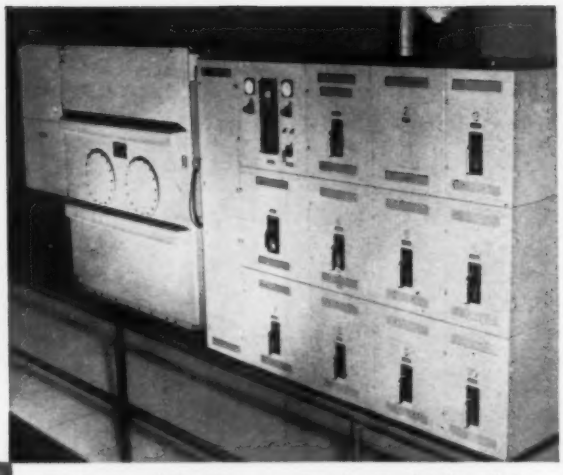
Only I-T-E offers you unit substations completely engineered and built in a single plant . . . insuring coordinated engineering, easier ordering, simultaneous delivery of all elements, simpler installation, and a single, dependable name in back of them. Write for complete details. Switchgear Division, I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.

I-T-E CIRCUIT BREAKER COMPANY

PHILADELPHIA, PENNSYLVANIA

Schlitz

adds power capacity ...modernizes distribution system with WAGNER TRANSFORMERS



This is one of the Wagner-equipped unit substations that modernize power distribution at Schlitz. The Wagner Sealed Dry-Type Transformer is rated 1000 kva.

Jos. Schlitz Brewing Company, Milwaukee, Wisconsin.

A continuing program of modernization is one of many reasons why the Jos. Schlitz Brewing Company is a leader in industry. Plant power distribution, for example, has been modernized and expanded to assure an uninterrupted flow of electric power for production of "The Beer That Made Milwaukee Famous."

Schlitz chose Wagner Sealed Dry-Type Transformers for their power distribution load centers. These modern unit substation transformers can be safely installed in any load center—any place—because they are hermetically sealed in welded steel cases to provide positive protection from contamination, fire and explosion hazards. The only maintenance they require is a periodic checking of gas pressure (inert nitrogen), case and bushings.

Wagner Sealed Dry-Type Transformers can serve your power needs just as they do at Schlitz. They are "Predesigned"—coordinated with the specifications of unit substation builders to save job engineering, time, and money. Consult the nearest of our 32 branch offices, or write for Bulletin TU-214 for full information.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

...to help America LIVE BETTER—*Electrically*

Wagner Electric Corporation
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

LIVE BETTER ELECTRICALLY

WT58-9

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

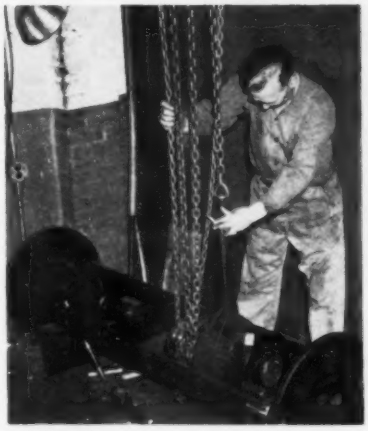
Hydraulic-Screw Press Exerts 10-25 Ton Thrust

Pressing out armature shafts, pushing bearing on or off and other similar jobs requiring the use of high-order pressure is facilitated in the shop of the Electric Motor Service Co., of Chester, Pa., by use of a shop-made combination hydraulic-screw press.

As noted in the accompanying illustration, the rig consists essentially of two parallel horizontal bars that extend between two circular base plates, one of which supports the pressing jack, while the other plate forms a collar that exerts a counter pressure on the shoulders of the armature being worked upon. The second plate also has two rectangular holes to permit the passage of the parallel arms. Side arms are drilled so that steel pins can be inserted at 6-in. intervals, thereby adjusting the overall distance between jack-head and collar-plate.

Using a hand lever, the jack can exert a pressure up to 10 tons and, using hydraulic pressure, this pressure can be increased to 25 tons.

Since an overhead monorail passes above this horizontal press, armatures may be carried to and from other shop areas by means of a travelling chain hoist and sling.



ARMATURE is lowered into position between jack-head and retaining collar-plate of horizontal pressing rig capable of creating a 10-ton lever-operated or 25-ton hydraulic-activated thrust.

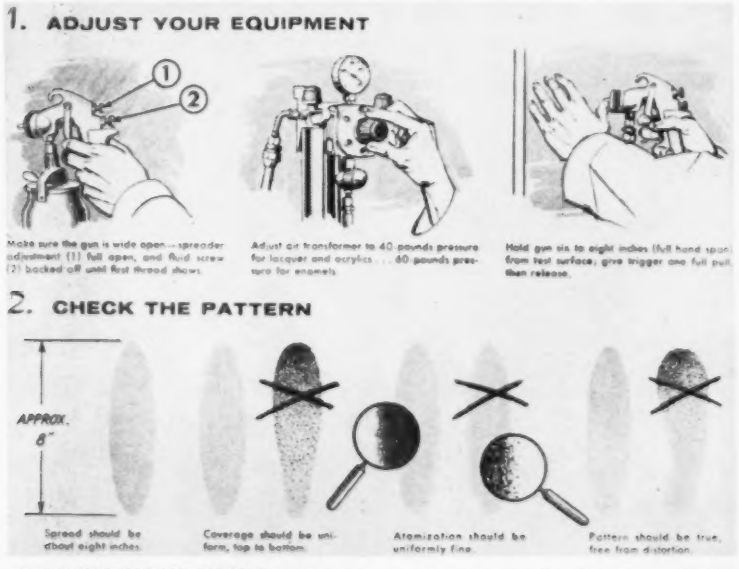
Color-Coded Tags Indicate Motor Status

Every three months the Penn Electric Motor Company of Philadelphia changes the color of its motor tags, progressively rotating from yellow to blue to red to white. With this system, motors in stock or awaiting pick-up can be visually classified as to the approximate length of time they have been on the shelves. And, if a tag shows that a motor has been awaiting pick-up for over a 3-month period, the motor is delivered to the customer's premises. These frequent visual checks and periodic delivery schedules prevent a motor from being "forgotten" in stock, and it also cuts down the amount of storage space required for this purpose.

Tags are in three sections, separated by perforation lines. One section remains with the motor until it is delivered, while the other two sections are retained by Penn Electric.

Of these two sections, the larger portion (approximately 3 by 5 in. in size) contains the customer's name, address and phone number; the date the motor was brought into the shop for repair; the horsepower, model and serial number; plus an indication of required repairs, the invoice number, contract price and final delivery date. This section is torn off when a motor starts its progressive tour through the repair department, although it remains conveniently available for check purposes.

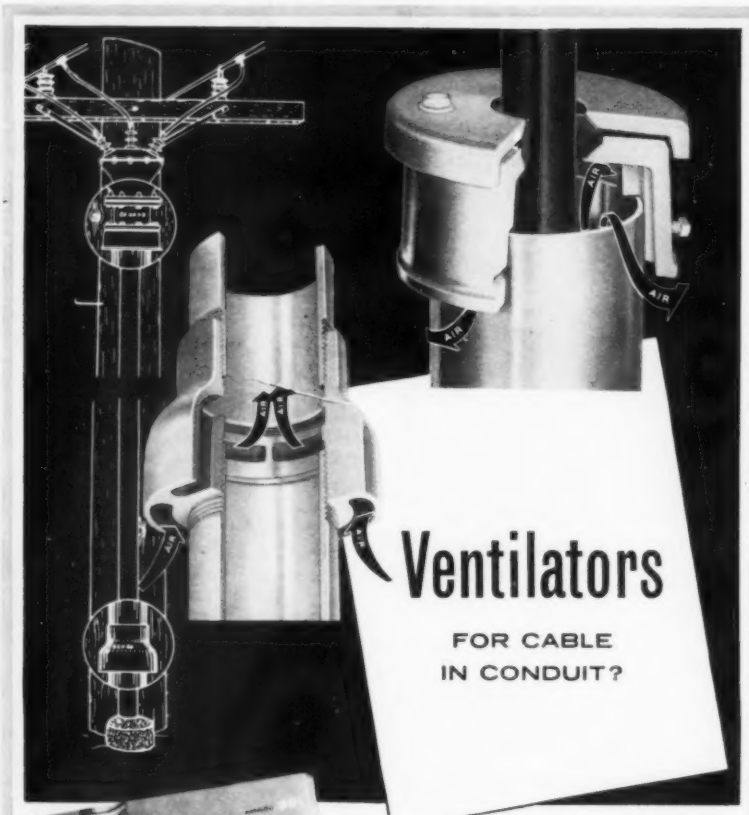
The second section contains a detailed check-off list to guide the billing department listing such items as armature and commutator, brushholders and shafts, stator and brake, switches and bearings, rubber mountings, and so on. When repairs have been completed, this section is torn off, clipped to the larger card and sent to the shop office, where both parts are used for billing and inventory purposes. All three sections, of course, carry identical file numbers so that they can be correctly matched up.


1. ADJUST YOUR EQUIPMENT
1
2
Make sure the gun is wide open — spreader adjustment (1) full open, and fluid screw (2) backed off until first thread shows.
Adjust air transformer to 40 pounds pressure for lacquer and acrylics . . . 60 pounds pressure for enamels.
Hold gun six to eight inches (fist hand span) from test surface; give trigger one full pull, then release.
2. CHECK THE PATTERN
APPROX. 8"
Spread should be about eight inches.
Coverage should be uniform, top to bottom.
Atomization should be uniformly fine.
Pattern should be true, free from distortion.

CHECKING SPRAY GUNS for efficiency of operation can be done by a simple test advocated by engineers of The DeVilbiss Company, Toledo, Ohio. If any of the characteristics fail to check out as shown, the spray gun is defective, according to the engineers, and will result in a waste of material, time and effort in addition to poor quality of work.

Auxiliary Ducts Raise Oven Temperatures

The bake oven in the shop of Philadelphia's Electric Apparatus and Repair Company formerly had a 300-degree limit, the source of this heat being a gas-fired unit, with heat passing through the oven to an exhaust hood above. Now, however, temperatures up to 500 degrees are possible, for a second heating unit, fired with oil, is now located outside of the oven proper with auxiliary



this PLM catalog tells how, where and why to use them!

Load capacity of cable in conduit can be increased . . . added years of service life can be obtained . . . by proper use of conduit ventilating cable supports in vertical risers where heat concentrates.

PLM Catalog 301 shows how to do it . . . lists types of ventilating supports for both new and existing installations, and with or without flanges to support potheads. It also lists and illustrates the full line of PLM standard armored cable terminators and splices as well as PLM unit package terminating and splicing kits. Write for your copy. PLM Products, Inc., 3875 W. 150th St., Cleveland 11, Ohio.

PLM Terminators
Splicing Kits
Conduit Ventilators

DOUBLE S DUCT arrangement at rear of baking oven contains hot air from gas-fired burner, while second hot-air system related to separate oil-fired unit boosts oven temperature to 500-degree range.

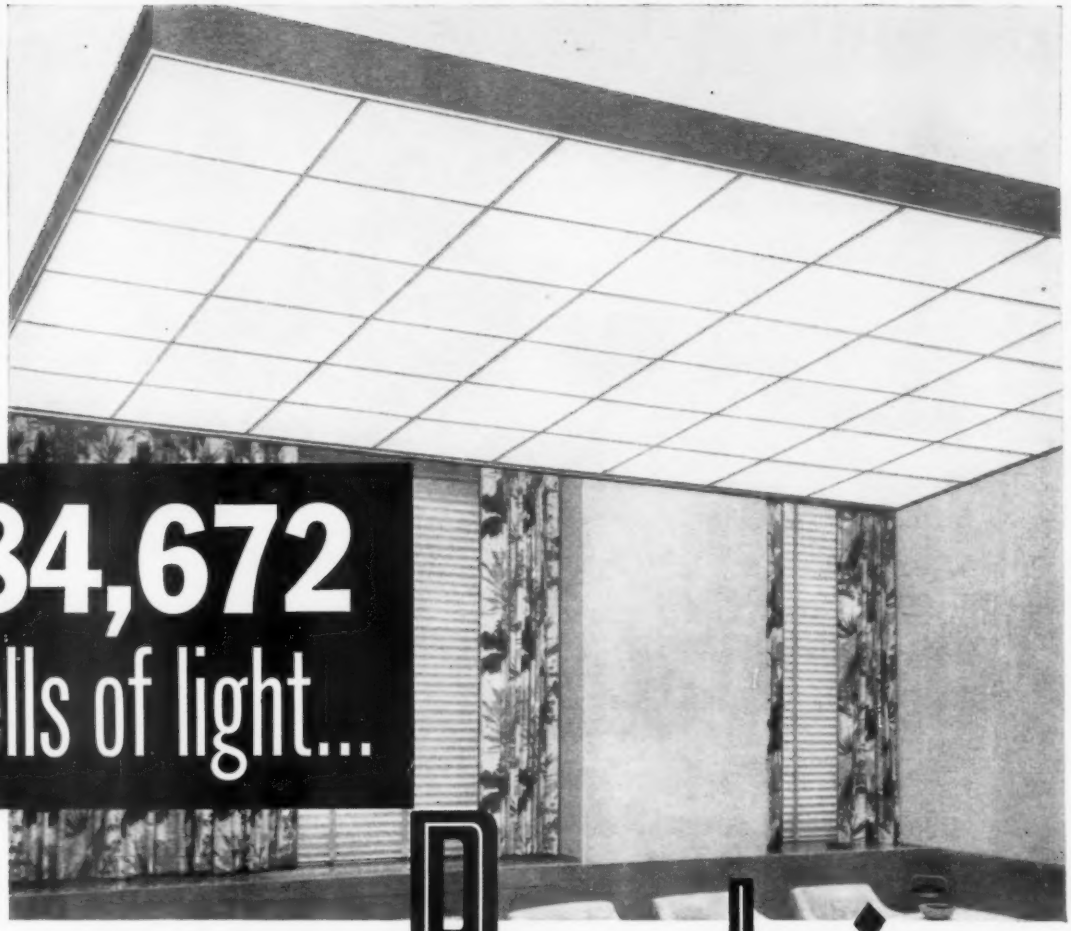
ducts carrying this thermal boost into the chamber.

This multiple-source heating system has also been improved by arranging the ducts in a "double S" pattern, thereby retaining the hot air within the heating chamber for a longer period before exhausting.

Traveling Tray Boosts Shop Efficiency

A wooden frame supported by four corner chains attached to a pair of monorail trolleys, has proved a definite time-and-labor saver for the Lange Electric Co., Baltimore. Running from the receiving counter back to the shop, the overhead rail track passes above all work areas, thereby making it possible to transfer small motors or parts as it is pushed.

SUSPENDED PLATFORM used to transfer numerous motors or parts from one area to another with minimum effort on the part of shop employees.



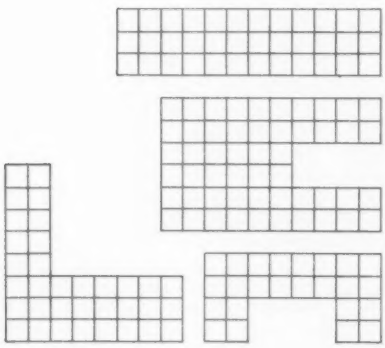
84,672 cells of light...

IN THIS "FLOATING PANEL" LUMINAIRE COMPOSED OF ONLY FOUR STANDARD UNITS OF

Panelaire

a new idea in large area illumination

"Panelaire" offers both a functional and flexible tool for unlimited freedom of design. This permits the designer to incorporate illumination as an integral part of any overall architectural design.



Panelaire gives you tomorrow's lighting today. This is the world's largest factory assembled luminaire. Modular Luminaires from 2′ x 4′ to 6′ x 8′ may be ganged together making areas, islands or lines of light with equal ease. A single unit will cover an area 6 x 8 ft. and enables you to fit any ceiling area with a minimum of modular sections. Illumination levels up to 300 f.c. may be attained by use of either 430 or 800 MA Lamps. A variety of available diffusers may be easily interchanged. The 12′ x 16′ "Floating Panel" illustrated is installed with only 6 stem hangers. "Panelaire" provides wall-to-wall lighting where desired. Send today for illustrated booklet and photometric data on this newest "pacesetter" in the lighting industry.

LPI

LIGHTING PRODUCTS INC.
HIGHLAND PARK, ILLINOIS

Pacesetter in the Lighting Industry

LIGHTING PRODUCTS INC.,
Dept. **4-D**, Highland Park, Ill.

Please send full details.

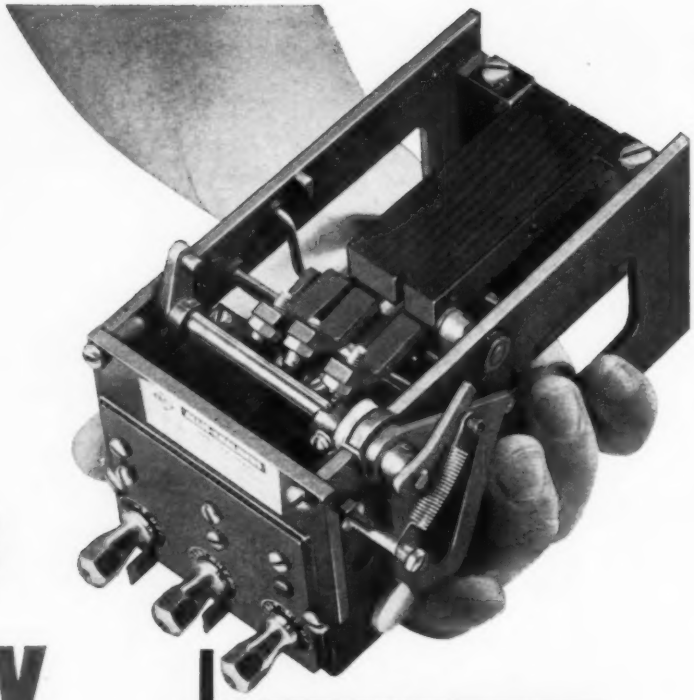
Name _____

Firm _____ Title _____

Address _____

City _____ State _____

ALLIS-CHALMERS
low voltage
switchgear



Here's

Proven Accuracy

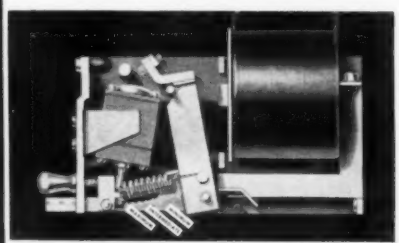
3 independent elements available in series trip device

This time-proven feature of Allis-Chalmers low voltage switchgear provides:

- **Accurate settings** — Adjusting knobs with calibration scales on front of trip device permit operator to adjust elements independently and set pickup for long time (80-160%), short time (500-1000%), and instantaneous (500-1500%).
- **Accurate action** — Silicone oil-filled, positive displacement time-delay device is completely calibrated and sealed under vacuum.
- **Accurate adjustment** — Minimum, maximum and intermediate time-delay band settings are field adjustable for each pickup value for fine selectivity.
- **Accurate indication** — Overcurrent trip flag to indicate phase which caused tripping of breaker is available.

Each trip element has its own armature and each armature acts directly on trip block. Accurate trip device is only one feature of Allis-Chalmers low voltage switchgear. For complete details, call an A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Operator inserting circuit breaker using positive-position pantograph. Note trip device accessibility, dead-front breaker, and drawout interlock.



Cutaway shows arrangement of components in Allis-Chalmers direct-acting series trip device. Note calibration scale below adjusting knobs and time band setting on armature extension.

A-5553

ALLIS-CHALMERS

PLACE 2¢
STAMP
HERE

The Editor
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.,
New York 36, N. Y.

PLACE 2¢
STAMP
HERE

The Editor
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.,
New York 36, N. Y.

Your Name and address will be reproduced and sent to the appropriate manufacturers. Illegible or incomplete addresses may result in your not receiving the information you desire.

FOR MORE INFORMATION ON

NEW PRODUCTS
CATALOGS, BULLETINS
ADVERTISEMENTS

USE THESE CARDS

- **PRODUCT NEWS, PRODUCT BRIEFS:**

  Use first line of boxes. Insert item numbers of products on which more information is desired.

- **CATALOGS, BULLETINS AND ENGINEERING DATA:**

  Use second line of boxes. Insert item numbers of literature desired.

- **ADVERTISEMENTS:**

  Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

IMPORTANT...

- PLEASE PRINT LEGIBLY
- USE BLACK OR DARK BLUE INK
- DO NOT USE PENCIL OR RUBBER STAMP

FOR MORE INFORMATION ON

NEW PRODUCTS
CATALOGS, BULLETINS
ADVERTISEMENTS

USE THESE CARDS

- **PRODUCT NEWS, PRODUCT BRIEFS:**

  Use first line of boxes. Insert item numbers of products on which more information is desired.

- **CATALOGS, BULLETINS AND ENGINEERING DATA:**

  Use second line of boxes. Insert item numbers of literature desired.

- **ADVERTISEMENTS:**

  Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

IMPORTANT...

- PLEASE PRINT LEGIBLY
- USE BLACK OR DARK BLUE INK
- DO NOT USE PENCIL OR RUBBER STAMP

Please send me without obligation further information about the following: 4/58

Product News and Product Briefs, Item Number

Catalogs and Bulletins, Item Number

Advertisement on Page

NAME ..... TITLE .....

COMPANY .....

ADDRESS .....

.....

ELECTRICAL CONSTRUCTION AND MAINTENANCE — A McGraw-Hill Publication

NOT GOOD AFTER JUNE 1, 1958

Please send me without obligation further information about the following: 4/58

Product News and Product Briefs, Item Number

Catalogs and Bulletins, Item Number

Advertisement on Page

NAME ..... TITLE .....

COMPANY .....

ADDRESS .....

.....

ELECTRICAL CONSTRUCTION AND MAINTENANCE — A McGraw-Hill Publication

NOT GOOD AFTER JUNE 1, 1958

Your Name and address will be reproduced and sent to the appropriate manufacturers. Illegible or incomplete addresses may result in your not receiving the information you desire.

Product News

Circuit Breaker Enclosures (1)

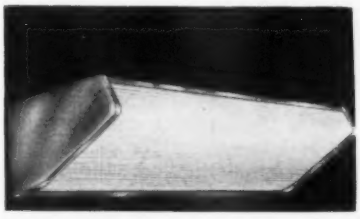
A complete new line of molded case circuit breaker enclosures in general purpose and raintight designs for virtually all frame sizes from 15 to 800 amps. Equipped with insulated groundable neutrals in all devices through 100 amps. NEMA Type I enclosures are available in flush and surface mountings with either external handle-operating or handle-through-cover operation. 800 amp enclosures furnished without knockouts. Raintight, NEMA Type 3R, enclosures are constructed of galvannealed code gage steel. All NEMA Type I and 3R enclosures are Bonderite treated and finished with baked enamel. NEMA Type I enclosures with external handle are fitted with cover and gasket. Also available are cast iron watertight NEMA Type 4 & 5 dust-tight enclosures for outdoor, damp or dusty locations.

General Electric Co., Plainville, Conn.

3-Pole Plug-in Breaker (2)

A line of 3-pole plug-in circuit breakers in ratings from 15 through 70 amps, 240 volts, designed to serve as main disconnects in standard lighting, power, and combination panelboards, both 3-phase and 3-phase, 4-wire. Breakers can also be used for 3-phase motor circuit. For 3-phase, 4-wire delta system applications where a 3-pole breaker in ratings from 15 through 40 amps, 240 volts is available. These units provide 3-phase motor loads in a standard "dual-rated" single phase lighting and appliance panel. Also suitable for use as a disconnect and for overcurrent protection on single phase 240-volt applications to disconnect live legs and neutral.

Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.



Wall Light (3)

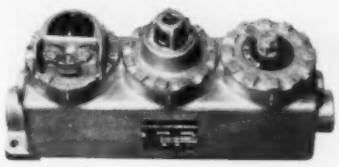
New "37-60" line of wall fixtures is suitable for lighting mirrors, stair landings, fitting rooms, telephone tables, etc. Available for two 60-watt incandescent, or two 15-watt T-8 fluorescent lamps. Unit measures 18¾ ins. long, 4¾ ins. high, and extends 6¾ ins. from wall. Finished in grey enamel.

McPhilben Lighting Co., 1329 Willoughby Ave., Brooklyn 37, N. Y.

Contactor (4)

A new size 8, type 425-8D, ac clapper-type 3-pole magnetic contactor rated 1350 amps at 600 volts. Features ACBO arc interruption, self-aligning bearings, and mill-duty auxiliary interlocks. Is 39 in. wide, 19½ in. high, 17⅜-in. deep, and is mounted on a 1½-in. ebony asbestos panel. Available in two or three poles alternately mounted with magnet assemblies; contactor is dc-operated from 110-volt ac rectified source. Up to four NO and four NC auxiliary contacts can be mounted on a 3-pole contactor. Particularly adapted for opening and closing circuit to heating element of electric ovens and furnaces, starting motors up to 900 hp maximum at 440 volts and 450 hp maximum at 220 volts.

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.



Control Stations (5)

A new EWC series of control station and pilot light condulets of threaded joint construction that can be used indoors or out. Explosion and dust ignition proof, weather resistant and rain tight, the series features an aluminum cover with feraloy housing. Joints of the cover opening, operating shaft and pilot light jewel are sealed with neoprene O-rings. Available in 1, 2 or 3 gangs, push-button stations, pilot lights and selector switches; designed for Class I, Groups C and D, and Class II, Groups E, F and G.

Crouse-Hinds Company, Wolf & Seventh North Sts., Syracuse, N. Y.

Resistor Rack (6)

New self-standing rack provides easier mounting of mill-type resistor sections. Called "Uni-Stack", this rack can be mounted in position before resistor sections are installed. Available in 7 sizes to accommodate from three to nine "Tab-Weld" standard mill sections. Only two front bolts are required to hold individual sections in place. Resistors available in ratings up to 500 amps continuous.

Electric Controller & Mfg. Co., Div. of Square D Co., Cleveland 28, Ohio.

Latrobe *Electrical* Products

"Latrobe" Floor Boxes and Wiring specialties are clean and compactly designed to cut installation time to the bone and give smooth, trouble-free service.

"Latrobe" Products give a full measure of value.

Non-Adjustable Watertight Floor Box

Unique, practical design cuts installation time; makes safer job and leaves more wire space inside box. Cover Plate is 3½" diameter.

Adjustable Floor Box

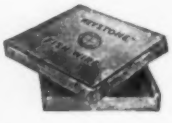
Designed for telephone outlet or where permanent connections are made, or as a junction box. All adjustable boxes are fireproof.

Insulator Supports

Fasten porcelain or glass insulators to steel framework without punching holes. 3 sizes—1", 1½", 2" and 2½".

Keystone Fish Wire

Ten sizes — for lightest work to heaviest power wiring. 100, 150, and 200 foot coils.



Latrobe Products

Non-Adjustable Floor Boxes
Adjustable Floor Boxes
Gang Boxes . . . Cover Plates
Junction Boxes . . . Nozzles
Pipe or Conduit Hangers
Insulator Supports
Cable Supports . . . Fish Wire
Staple and Cable Clips

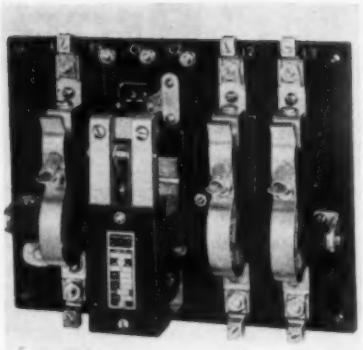
WRITE FOR NEW CATALOG

Sales Representatives in all principal cities.

Fullman Manufacturing Co.

1209-1215 JEFFERSON STREET

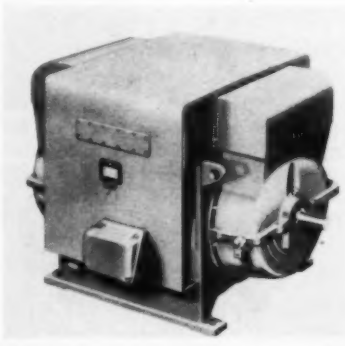
LATROBE, PA.



Contactors (7)

New magnetic contactors are now available in mechanically held models, series "11000", and electrically held models, series "21000". Both series available in one, two, and three poles, rated 30, 70, 100, 150, 200, and 300 amps. 11000 series developed for use with standard SPDT time switch. Two coils operate the contacts, one for opening and the other for closing; so designed that they take themselves off the line after operating the contactor. Any number of momentary contact switches may be installed at remote points for manual operation. 21000 series, on flasher duty, can operate 60 times per min. at 80% of rated load. Parts may be inspected and replaced without disturbing any other part of the contactor. Full floating armature permits magnetic seating and reduces AC hum to a minimum.

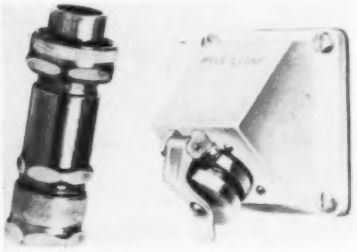
Paragon Electric Company, Two Rivers, Wis.



Motors (8)

A new line of weather protected motors designed for outdoor operation is available in ratings from 250 to 1500 hp. Motor's ventilation system prevents the entrance of wind-borne particles and moisture by forcing incoming airstream through a number of abrupt changes in direction and sharp decreases in velocity. Standard features include split-sleeve bearings and bearing brackets that allow on-the-job removal or inspection; newly developed moisture and chemical resistant insulation; low temperature space heaters.

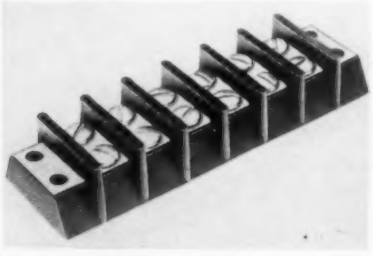
Louis Allis Co., 427 E. Stewart St., Milwaukee 1, Wis.



Connector (9)

A new line of plugs and receptacles are identified as Pyle-Star-Line circuit breaking series "C" connectors and are listed by UL for interrupting circuits in NEC, ratings of 30, 60, 100 and 200 amps, 600 volts ac. Receptacles incorporate the basic components of series "W" connectors which meet Class A, B, C and E requirements of Military specifications MIL-C-5015-C, and are available in cable connector, panelboard, bulkhead and conduit fitting types. Interchangeability of components permits many assembly combinations including a wide choice of contact configuration inserts ranging from 4 to 100 poles for power, control, and electronic circuits. Bulletin is available.

Pyle-National Company, 1334 N. Kostner Ave., Chicago 51, Ill.



Terminal Boards (10)

Terminal boards, called "GEN-PRO", feature solid back, higher barriers, and molded in conductors. Series can be marked on the barriers. Molded-in insert around the mounting holes provide increased strength. Odd lengths can be supplied.

General Products Corp., 26 Rittenhouse Place, Ardmore, Pa.

NOW! NEW! FABULOUS LUXWOOD® FIXTURES

Another MOE Light Promotional First that's new and powerful

FREE OFFER! INTRODUCTORY PRICES! FULL PROFITS!

FREE! This $12.95 ceiling track when you buy this beautiful pull-down fixture
MOVES ACROSS →
↓ PULLS DOWN
M-1479 real pull-down . . . Smartly designed for today's living. Match or contrast your furniture with elegant real wood. Specially treated to accent the beautiful natural wood grain when fixture is lighted.
Special Introductory Offer complete with FREE 6-foot brass ceiling track . . . $49.95

1 REAL WOOD FIXTURES

Here's beautiful "Wood-n-Brass" LUXWOOD—real cabinet wood fixtures dressed in gleaming polished brass . . . matching any decor by day, translucent by night—a *home* decorator's dream of beauty come true.

2 FREE OFFER

To spearhead your promotion and bring in customers . . . and at NO COST TO YOU!

3 SPECIAL INTRODUCTORY PRICES

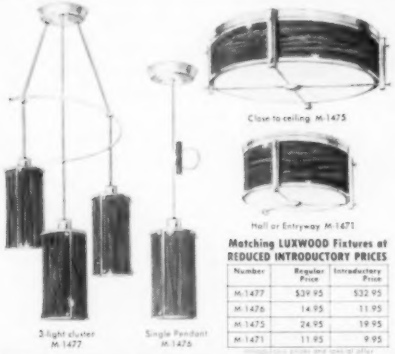
Reduced 30 day introductory prices to consumers . . . and you get your FULL PROFIT because you get special prices too!

4 POWERFUL PROMOTION

This full page—Full Color ad appears in April Better Homes & Gardens and House & Garden. A powerful push behind an exciting NEW line. Get in on this huge promotion TODAY.

This is Big! Let's go!

Special Prices and FREE offer expire April 30, 1958. Write, wire, phone your Distributor TODAY or send in coupon below.



Matching LUXWOOD Fixtures at REDUCED INTRODUCTORY PRICES

Number	Regular Price	Introductory Price
M-1477	$39.95	$32.95
M-1476	14.95	11.95
M-1475	24.95	19.95
M-1471	11.95	9.95

. . . to introduce stunning new

LUXWOOD®

by MOE Light

translucent fixtures of real wood

Here is LUXWOOD—most exciting lighting fixture idea in years . . . real cabinet grain wood trimmed in gleaming brass . . . actually translucent when lighted. Five matching fixtures to dramatize every room in your home.

To introduce LUXWOOD fixtures your dealer will give you a 6-foot brass ceiling track FREE (regular retail price $12.95) when you buy the M-1479 pull-down fixture shown above at the regular price of $49.95.

With the polished brass ceiling track and LUXWOOD pull-down fixture you can move the light up or down and 6 feet in either direction. Beautiful over dining tables, breakfast nooks or conversation furniture groupings . . . it's a conversation piece in itself.

Matching Luxwood fixtures by Moe Light are perfect for re-decorating home, office or store. Get these matching fixtures at special low introductory prices.

Special prices and free offer expire April 30, 1958

THOMAS INDUSTRIES INC.
LIGHTING FIXTURE DIVISION
Executive Offices—410 S. Third St., Louisville 2, Ky.
Leaders in Creative Lighting

THOMAS INDUSTRIES INC. products: Moe Light and Star Light lighting fixtures . . . Wright power saws . . . Radiant heat glass . . . Ideal bathroom cabinets . . . Electric Spraytt paint spraying equipment

THOMAS INDUSTRIES INC., Lighting Fixture Division, Dept. BH-4
410 S. Third St., Louisville 2, Ky.
Enclosed 25c in coin. Send 36 page full-color Moe Light Inspiration-Lighting decorator guide and catalog.

Name _____

Address _____

City _____ Zone _____ State _____

Builders, Electrical Contractors attach this coupon to your letterhead for copy of Moe Light catalog.

THOMAS INDUSTRIES INC.
LIGHTING FIXTURE DIVISION
Executive Offices: 410 S. Third St., Louisville 2, Ky.
Leaders in Creative Lighting

Thomas Industries Inc., MOE LIGHT Div., Dept. ECM-4
410 S. Third St., Louisville 2, Ky.

The MOE LIGHT Promotion looks good to me. Send me details.

Name _____

Store Name _____

Address _____

City _____ Zone _____ State _____

My Distributor is: _____

WIN THIS VOLKSWAGEN SERVICE TRUCK!

Remcon Contest for Electricians!

25 miles to the gallon. Thousands of dollars worth of the world's most modern motor-vehicle engineering. And it's *free* to the man who submits the most imaginative and practical use of REMCON on an actual installation.

Just pick up your Entry Envelope (with entry blank, full information and helpful suggestions) at your REMCON distributor – or write REMCON Division, Pyramid Instrument Corporation, Lynbrook, N. Y.

REMCON

REMOTE CONTROL SWITCHING DEVICES

Foot Control **(11)**

This foot operated control features a foot treadle that remains at any setting until repositioned, and a center pivot point to utilize heel and toe control. Available in three sizes to accommodate rheostats up to 150 watts and transformers up to 5 amps. Larger unit can control ¾ hp series wound motors when equipped with suitable transformer. Suitable for motor shop work and industrial plant production. Literature is available.

Coil Winding Equipment Company, Oyster Bay, N. Y.

Pipe Threader **(12)**

New "100" power driven vise weighs 77 lbs and turns pipe from ⅛ to 2-in. diameter. Unit features replaceable jaw inserts, self centering rear chuck, and ball bearing mounted gears. Optional drive unit available for handling pipe up to 12-in. diameter.

The Oster Manufacturing Co., 1340 East 289th St., Wickliffe, Ohio.

Transformer **(13)**

A new line of single phase power and lighting transformers features dual primary and secondary windings, low noise level, and low coil to core loss ratio. Available in 28

sizes from 50 va to 500 kva. Core and coils are well ventilated; coils are vacuum impregnated with polymerizing varnish and rigidly blocked to withstand internal stress. Has removable cover, clearly marked terminal leads, and diagramatic nameplate. Tested to meet or exceed NEMA, AIEE, and NEC Standards. Bulletin No. 100 available.

Hevi-Duty Electric Company, Milwaukee 1, Wis.

Arc Reducing Accessory (14)

A new power switching accessory designed to reduce arcing of line switches. Snap action of the accessory interrupts currents quickly and independently of the switch movement. Applicable on horizontal-break and vertical-break switches, the unit is rated 600 amps at 7.5, 15, 23, 34.5, 46 or 69 kv. Designated Type "PA", unit features simplicity of installation in the field, isolation of rod from current path when switch is closed, and controlled action of the rod after switch is opened.

Line Material Industries, Milwaukee 1, Wis.

Outdoor Motor (15)

A new outdoor motor featuring improvement in weather protection, ventilation and ease of maintenance. Available from 250 hp and up, motor has been designed to exceed the new NEMA Type II definition. Motors can be mounted side by side or close to other equipment without interfering with ventilation. Designed for use by utilities, pipeline, chemical, and petroleum industries.

General Electric Co., Schenectady 5, N. Y.

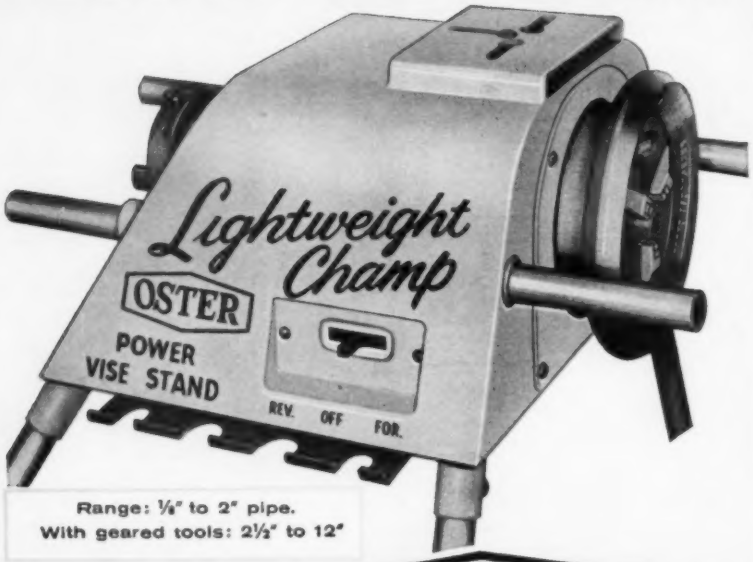
a new concept in Remote Control Switching by Remcon

This most beautiful switch of all tells at a glance whether lights are on or off anywhere in the house. It's the ultimate in remote control light. Each switch on the hi-fashion Remcon plate has its own tiny 6-volt gem-light. The pilot lite circuitry employs the three wires used for wiring switch; no additional wiring or transformer needed. That's real convenience . . . *real* remote control. That's *Remcon*. On *your* next job, use easy-to-install Remcon Pilot-Lite switches and relays. Just a few pennies more than conventional switches. See your jobber or write Pyramid Instrument Corporation, Lynbrook, N. Y., makers of the world-famous AMPROBE.

REMCON

REMOTE CONTROL SWITCHING DEVICES

PORTABLE, BUT BIG TOUGH AND RUGGED!



Range: ⅛" to 2" pipe.
With geared tools: 2½" to 12"

OSTER

NO. 432 Lightweight CHAMP

...the Heavy-duty Power Machine built to outlast any Portable Pipe Threader on the market!

OSTER

Builders of the World's Most Complete Line of Threading Equipment

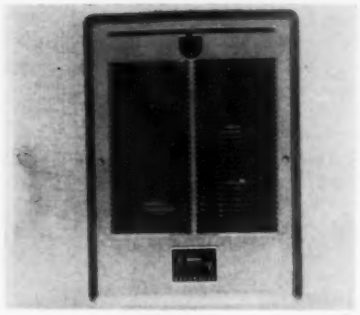
For other Models write for General Catalog

Rugged, all-steel construction makes the Oster No. 432 practically indestructible. Powerful heavy-duty motor is fully protected from dirt and weather.

NEW "POWER-MATIC" FRONT CHUCK automatically grips pipe tight for both left- and right-hand operation. Replaceable jaw inserts eliminate need for jaw sharpening, can be replaced quickly and easily at low cost. Universal-centering rear chuck aligns pipe perfectly for sharp, clean, threads.

See Your Oster Distributor or Write Today!

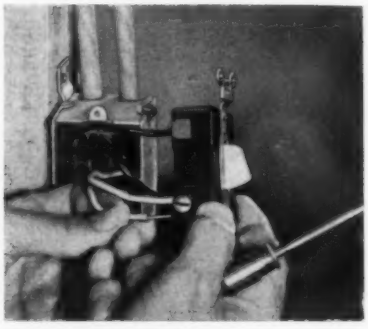
THE OSTER MANUFACTURING CO. • 1313 East 289th St., Wickliffe, Ohio



Electric Wall Heater (16)

Recessed wall-mounted electric heater has manual or thermostatic controls and is rated at 1650 watts. Dimensions are 3¾ ins. deep, 14⅝ ins. high, and 10¼ ins. wide. Improved louver design directs the flow of warm air downwards to the floor area. Rated 120- and 240-volt, ac.

Thermador Electrical Mfg. Company, 5119 District Blvd., Los Angeles 22, Calif.



Press-Action Switch (17)

"Presswitch" is a new ac, press-action switch designed for all ac applications, particularly large fluorescent installations in offices, factories and institutions. It has an additional terminal screw to be used as a splice point. The terminal screw will take two wires of sizes 14 to 10 AWG. Switch fits standard wall boxes and uses standard wall plates. Available in single pole, double pole, 3-way, and 4-way, with ivorine or brown nylon button.

Harvey Hubbell, Inc., Bridgeport 2, Conn.

Jam Protector (18)

New jam protector panel, called "I.J.P.", is for conveyors, machine tools, automation equipment and other industrial machinery. Power is automatically locked out until jam is cleared. Pressing a button resets protection device. Red light

indicates the overloaded motor. Three phase power is hooked up to panel and motor leads run out to individual drive motors. Model with starting switch measures 30 by 20 by 7¼ in. deep; model without starter measures 14 by 16¼ by 6¼ in.

Palmer-Bee Co., Opdyke Rd., Bloomfield Hills, Mich.

Selenium Battery Charger (19)

New selenium battery charger, known as the "Selenicharger", is completely self-protected and automatic in operation. Recommended for heavy-duty uses such as diesel and gas engine starting where batteries are used for the actual starting and where remote operation must be completely automatic. Visual or audible signal can be supplied as an optional feature to indicate when a short occurs in the batteries or wiring. In sizes from 5 to 1000 amps for batteries from 6 to 230 volts.

Selenicharger Div., American Rectifier Corp., 95 Lafayette St., New York 13, N. Y.

Mercury Street Light (20)

"Form 700C" is a new 700-watt luminaire using clear or color-improved mercury vapor lamps. Useful for street lighting in heavy traffic areas where lamp replacement is a problem. Tests show an average of 26,400 lumens throughout 12,000-hr lamp life, or 27,400 lumens throughout 9,000-hr lamp life. Ballasts available for series or multiple operation. Space provided for integral mounting of photoelectric control cell. Unit features a one-piece combination reflector-housing, a heat-resistant glass refractor, a new slipfitter mounting.

General Electric Company, Schenectady 5, New York

VERSATILITY sells CADWELD electrical connections

CADWELD electrical connections have 5 basic outstanding features:

1. Permanent — cannot loosen or corrode.
2. 100% current carrying capacity.
3. Compact — easily installed.
4. Light weight equipment.
5. Portable equipment — requires no outside source of power or heat.

BESIDES THESE FEATURES IS A SIXTH MAJOR POINT THAT OUTSELLS ALL FIVE — *VERSATILITY*

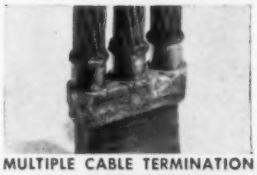
Once any customer has made a CADWELD electrical connection he knows the process. From that point, the only change is in the individual mold design. Todays catalog, lists over 58 basic types of connections — one year ago, there were only 32. The specials have become standards, because our customers approve the high quality of CADWELD and request it on new applications every day.

Send in your special electrical connection, it will be a standard CADWELD connection tomorrow.

TUBULAR BUS TERMINATION

MULTIPLE TAP CABLE TEE

CRANE RAIL POWER FEEDER


MULTIPLE CABLE TERMINATION

BUS BAR ELL

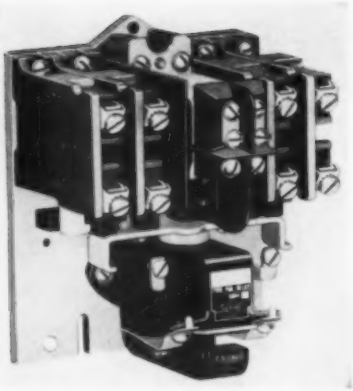
CONDUCTOR TRANSITION JOINT

CADWELD®

Erico Products, Inc.

2070 E. 61st Place Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario



Mechanically-Held Relay (21)

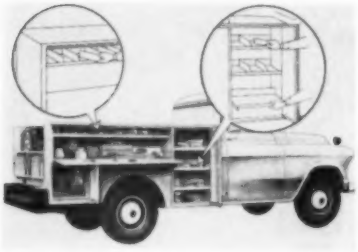
A new compact mechanically-held latched-in relay, type "PML", is available with two to ten poles. Parts are interchangeable with magnetic type PM relays. Access for wiring, inspection of contacts, and removal or replacement of poles or latch unit is from the front. Wearing surfaces are nylon on phenolic. No vibration or shock is transmitted to the linkage between contact carrier and magnet. Available in NEMA I general-purpose enclosures.

Clark Controller Company, Cleveland, Ohio.

MV Reflector Lamps (22)

Two new R60 and R80 reflector vapor lamps of 250 and 700 watts are weatherproof for outdoor use. With three light patterns, these lamps are useful in plants for low, medium and high bay locations; also for parking areas, service stations, and other active areas. Bases are nickel-plated brass.

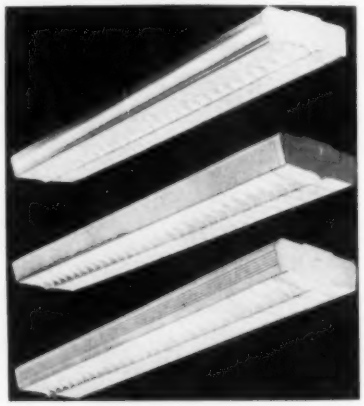
Radiant Lamp Corporation, 300 Jelliff Ave., Newark 8, N. J.



Truck Body (23)

Utility truck bodies are specially "job-planned" for the electrical industry with removable shelves as well as removable and adjustable shelf and tray dividers. All shelves are mounted on steel brackets. Three-dimensional slots in all shelves and material trays permit optional spacing of dividers on 1-in. centers; bins can be adjusted to any required dimensions. Features include weathertight compartment doors; reinforced tailboard, heavy duty safety-tred plate floors.

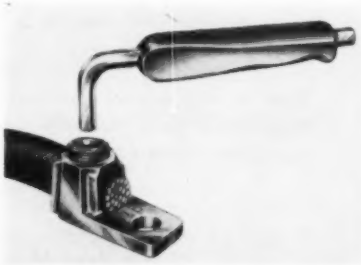
Reading Body Works, Inc., Reading, Pa.



Fluorescent Fixture (24)

The "Stylist" is a new series of fluorescent fixtures with mechanical improvements such as spring latches on louver-cover with jack chain hangers for easy access to wires and ballasts; installation in continuous rows without need of couplers; and slide hanger tracks along entire length for easier installation. Three shieldings available: 35°C x 25°L, 35°C x 35°L, and 35°C x 45°L.

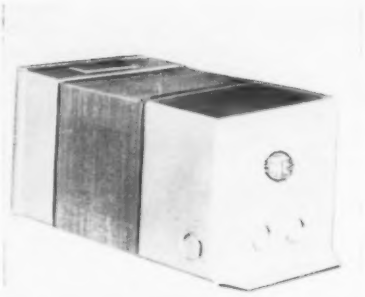
Electro Silv-A-King Corp., 1535 South Paulina St., Chicago 8, Ill.



Cable Lugs (25)

Compact one piece cone-screw cable lugs are made of high conductivity copper with a non-tarnishing, corrosion-proof finish. These cone-screw lugs are available in sizes No. 14 AWG to 500 MCM. Hex-socket installing wrench with plastic handle provided in each package.

The Thomas & Betts Co., Elizabeth, N. J.



Lightning Transformer (26)

New type "CB" lighting transformers available in 1, 2, and 3 kva sizes. Units have endbells instead of complete enclosures. This type of construction allows the core to be exposed to air. Terminals and wiring are contained in endbells. Rectangular shape presents neat appearance.

Marcus Transformer Co., Inc., Rahway, N. J.

Fluorescent Lamps (27)

High output fluorescent lamps with bases to fit the special sockets required for 800 MA operation are now available. Designed for indoor and outdoor low temperature use. Employs rapid start operating principle. Made in regular standard colors. Made in standard lengths of 48, 60, 64, 72, 84, and 96-in.

Supro Lux Mfg. Co., 406 East 161st St., Bronx 51, N. Y.

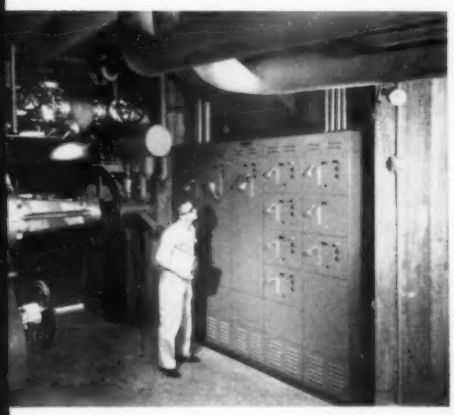
Cable Reel Stand (28)

The "Reelift" provides a safe rigid base for fast pay-out of cable and can be readily adjusted to handle reels up to 48-in. diameter. Device is all-welded heavy-duty construction with an industrial enamel finish. It measures 3 ft by 2 ft on the base 4 ft in height.

Hykon Manufacturing Co., P. O. Box 923, Alliance, Ohio

Cardinal Glennon Memorial Hospital for Children, St. Louis, Mo., occupies 4½ acres, employed 4,000,000 man-hours of labor in a three-year construction period.

One of two Westinghouse motor control centers with Type B wiring installed in hospital. Each starter has 480- to 110-volt individual control transformer for controlled circuit. J-94111-1

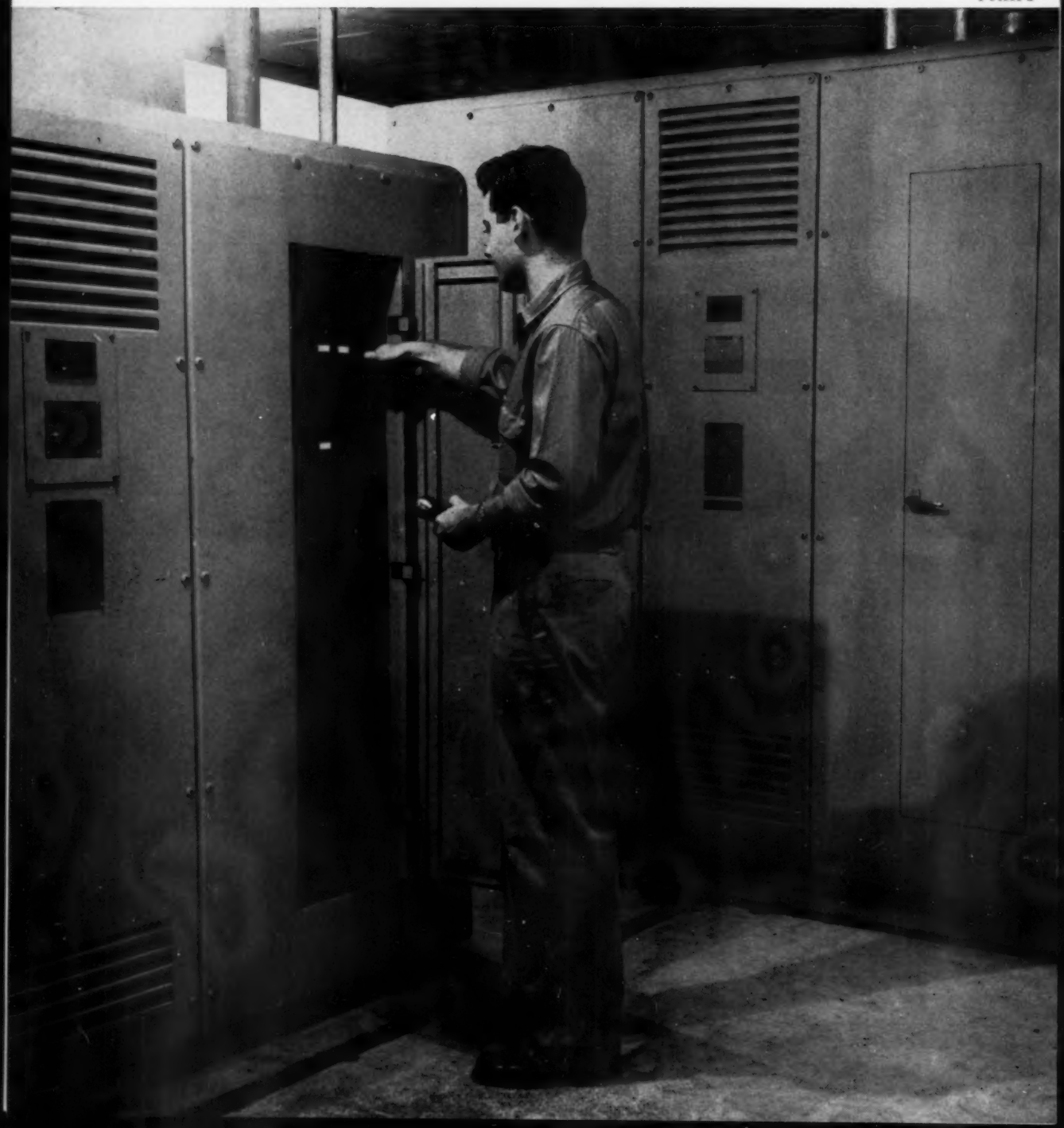


Fail-proof electrical system for children's hospital supplied by Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse

All-Westinghouse electrical distribution system was unanimous choice for long-term service

J-94111-2



Hospital conference room scene includes Norman H. Maas, Electrical Engineer for Maguolo and Quick, Architect; Joseph F. Dwyer, Manager of Hospital's Central Office and Coordinator of Building Committee; Sister Mary Vivian, S.S.M., Director of Occupational Therapy; Louis S. Sachs, S. C. Sachs Co., Inc., Electrical Contractor; (standing) W. L. Phiffer, Westinghouse Construction Sales Engineer; Paul Olschner, Westinghouse Area Sales Manager; and Walter R. Riechman, Westinghouse Electric Supply Co.

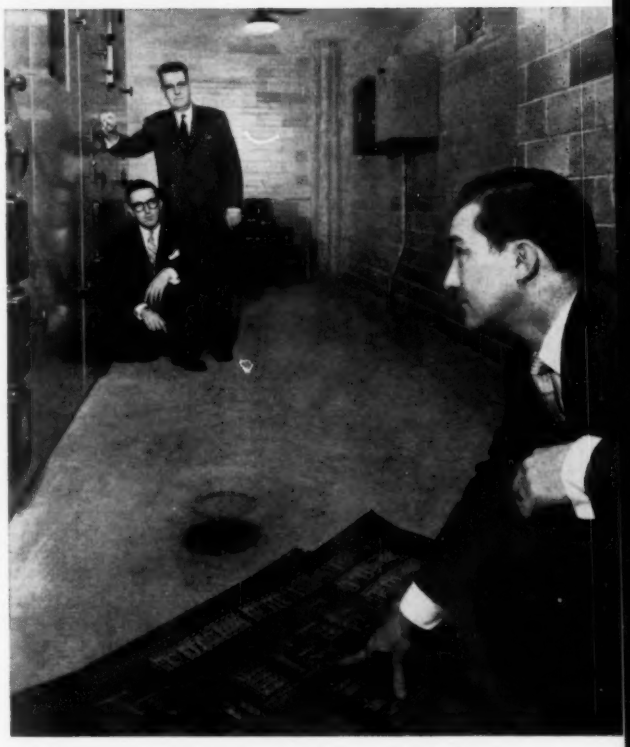
Selection of all-Westinghouse equipment for the electrical distribution system of the Cardinal Glennon Memorial Hospital for Children was made only after the many exacting requirements for hospital service were established and analyzed. The success with which the requirements are being met is shown in the quotes which follow:

The hospital manager reports, "During the 1½ years we have been in operation, the electrical distribution system has required no maintenance other than a periodic check by Westinghouse engineers. Inasmuch as this equipment was furnished by one manufacturer, we have the advantage of undivided responsibility along with a minimum parts inventory stock."

The electrical contractor adds, "The extensive cooperation by Westinghouse in scheduling shipments and in arranging larger shipments to facilitate handling provided us with the optimum flexibility we needed for the three-year construction period."

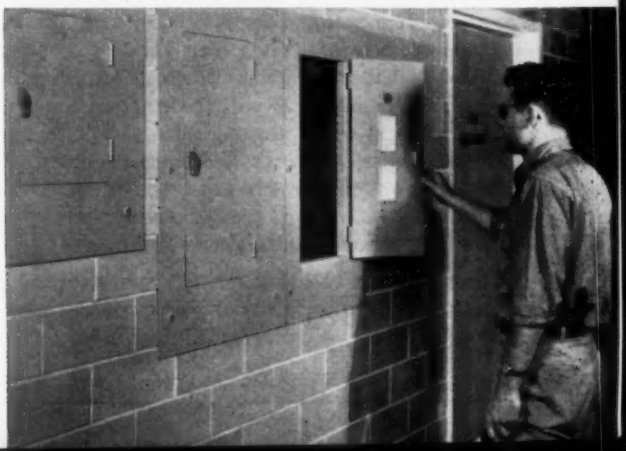
(continued)

YOU CAN BE SURE...IF IT'S Westinghouse



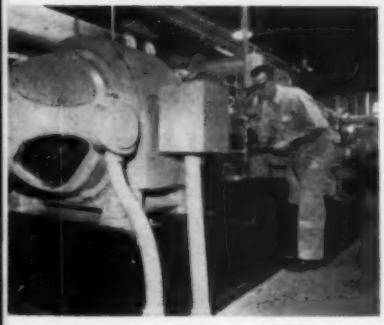
Engineers and contractors discuss Westinghouse metal-clad 5-kv indoor switchgear employing preferred-emergency incoming line transfer arrangement.

Westinghouse Type NLAB Quicklag® breaker lighting panelboards. A total of 42 lighting panelboards and 10 power distribution panelboards are installed in hospital.



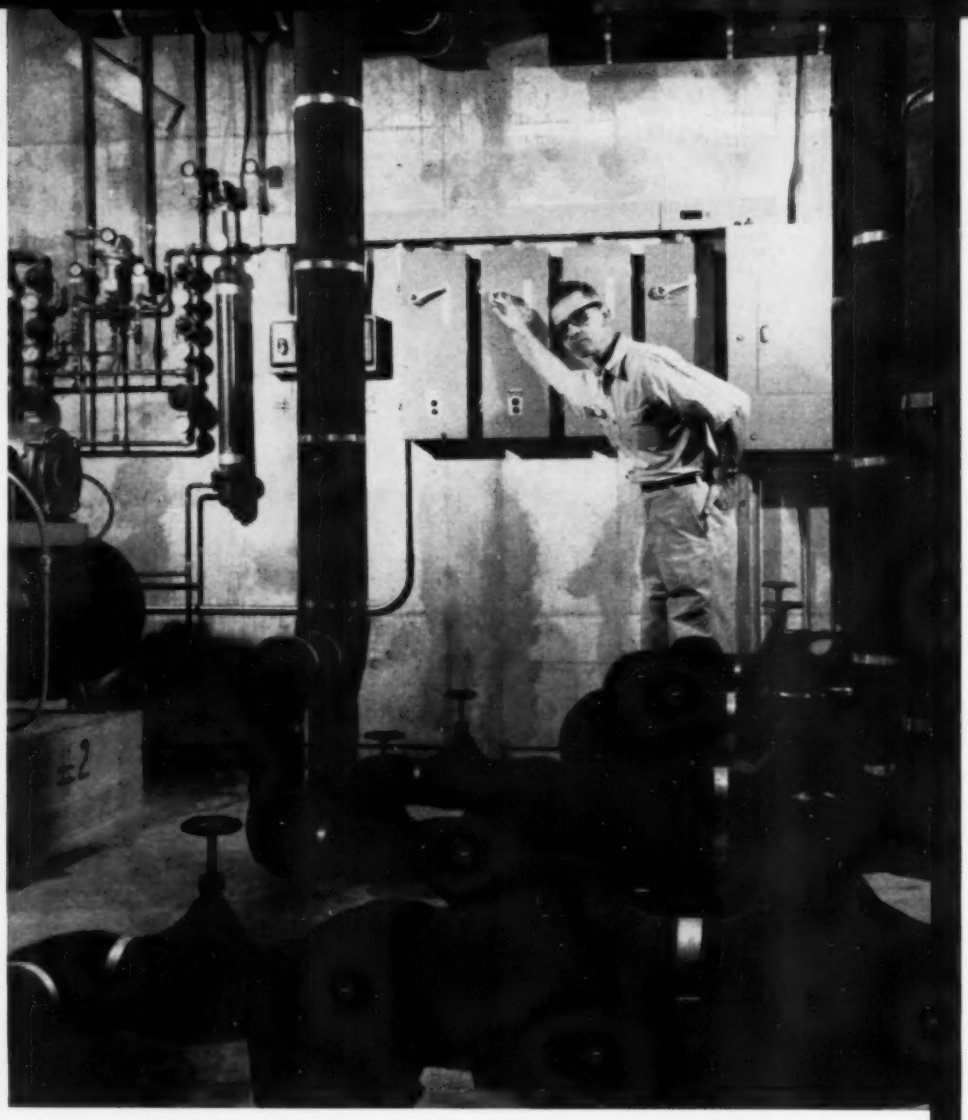
Transformer room close-up shows three of hospital's five Westinghouse dry-type self-contained power centers. 75-kva 208-volt wye to 120-volt delta ungrounded insulating power center is in foreground, and two 225-kva power centers are at rear.

J-94111-3



View of components in air conditioning compressor hook-up. In foreground is a Westinghouse 250-hp wound-rotor induction motor with Type SU double-helical-type speed increaser—1760 to 6750 rpm.

The Cardinal Glennon Memorial Hospital cares for children between the ages of one to twelve, regardless of race, color or creed.



Individual protection of vacuum pumps is provided by Westinghouse Class 11-204, Size 1 starters in NEMA 1 enclosures.

All-Westinghouse system unanimous choice for long-term service *(continued)*

The architect-engineering firm, reviewing the design and engineering which went into the hospital, says, "Our design criteria for the building was established at 100 years, and we selected all material and equipment on that basis. Because of the critical demand for absolute reliability on the electrical system in a hospital of this type, our first consideration was the duplicate primary service, with each 5000-volt feeder from a separate substation as a power failure safety factor. Our past experience with Westinghouse in working out this particular kind of transfer system in conjunction with their application engineers gave us the proved dependability we needed."

Details of some of the Westinghouse equipment used in the Cardinal Glennon Hospital are illustrated on these pages. Additional information about how Westinghouse helped meet the electrical needs of this hospital is available. Information is also offered in helping you solve your own electrical requirements. See the Westinghouse electrical construction engineer nearest you or write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

Cardinal Glennon Memorial Hospital for Children
Architect-Engineer: Maguolo and Quick
Electrical Contractor: S. C. Sachs Company, Inc.
General Contractor: John B. Gutman Construction Company
Westinghouse Distributor: Westinghouse Electric Supply Company

J-94111-4

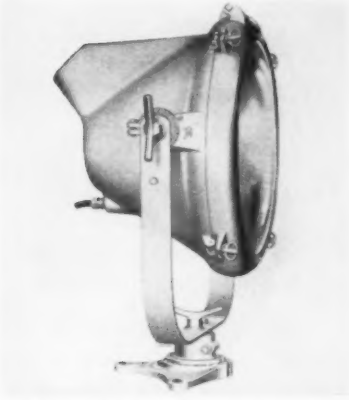
YOU CAN BE SURE...IF IT'S Westinghouse

Over 250 Pages
Westinghouse Data
in Sweet's Construction File

Explosion-Proof Fixture (29)

New type "EVA" explosion-proof fixture for use with mercury vapor lamps is for high bay applications. Fixture takes 250-watt Type BT-28/mercury vapor lamp for Class I, Groups C & D locations, and 400-watt Type BT-37 lamp for Class I, Group D. Standard 300-500-watt size EV reflectors are used. Ballasts used with mercury vapor lamps should be located outside the hazardous area.

Crouse-Hinds Company, Wolf & Seventh North Sts., Syracuse, N. Y.



MV Floodlights (30)

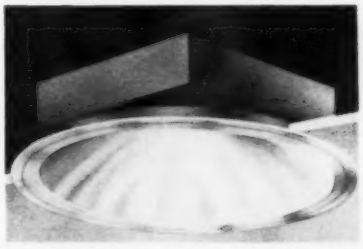
Mercury vapor floodlights are now available in a 10-in. size for 100 to 250-watt lamps, 14-, 16-, and 18-in. housings for 400-watt to 1000-watt lamps, and 20- and 23-in. housings for 700- and 1000-watt lamps. Cast aluminum construction. Safety features include automatic lamp receptacle cut-out during lamp replacement, and 3-conductor cords, when provided, to permit grounding the floodlight enclosure. Available with two reflector types, three to five lens types, and various mounting bases.

The Pyle-National Co., 1334 N. Kostner Ave., Chicago 51, Ill.

Low Voltage Switch with Pilot (31)

Without altering the basic principles of "Remcon" low-voltage remote-control switching, a new "Pilot-Lite" switch now contains its own tiny 6-volt lamp that indicates "ON" and "OFF". By adding another set of contacts in the relay, each pilot-lite is energized by the built in low-voltage transformer, when the switch is operated to "ON". Relay rated 15 amps, 120 volts ac.

Remcon Division, Pyramid Instrument Corp., 630 Merrick Rd., Lynbrook, N. Y.



Fluorescent Fixture (32)

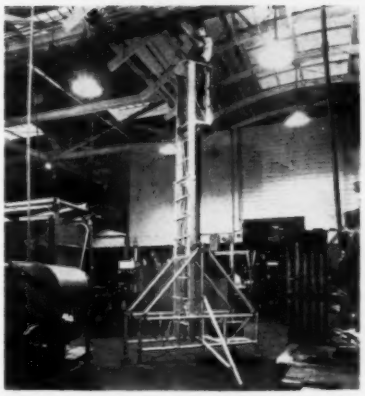
A new series of fluorescent fixtures features white plexiglas domes which can be installed in either concave or convex position. Domes are available in 2-ft diameters with a 3-in. bubble depth, and 3- to 6-ft diameters with a 5-in. bubble depth. Units use from four 20-watt trigger start in a 2-ft fixture to 12 40-watt rapid start fluorescent lamps in a square backbox which is concealed by the ceiling tiles. Face-trim and door are made of extruded aluminum with concealed hinges and latches. Suitable for commercial and institutional interiors.

Gruber Brothers, Inc., 125 South First St., Brooklyn 11, N. Y.

Post-Type Insulator (33)

A new post-type insulator designed for installation wherever a cantilever strength of 1500 lbs is adequate for distribution conductors. Has an especially wide conductor groove to accommodate all common types of conductors for voltages up to 25 kv, with hot-dipped galvanized malleable iron base casting for corrosion resistance. Poletop and angle brackets available for every mounting need. In 7- and 9-in. porcelain sizes, with $\frac{5}{8}$- by $1\frac{3}{4}$- or $\frac{5}{8}$- by 7-in. studs.

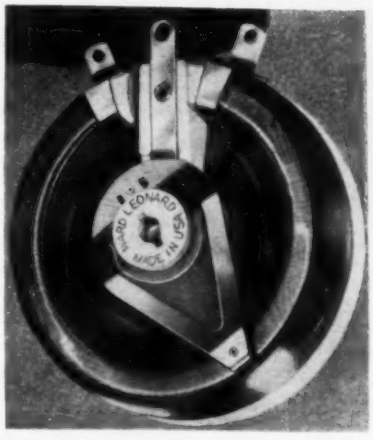
Ohio Brass Company, Mansfield, Ohio.



Ladder Scaffold (34)

Telescoping aluminum scaffold called "TALLescope" provides working platform to heights of 30 ft. Lightweight, rapidly assembled by one man. Legs adjustable for uneven floors or stairways. Telescopes and folds down to 29-in. width for rolling through doorways and congested areas. Separates into three units for storage and transportation.

Up-Right Scaffolds, 1013 Pardee, Berkeley, Calif.



Ring Rheostats (35)

These new 100- and 150-watt rings are recommended for rheostat or potentiometer use in electronic, industrial and other control equipment where gradual resistance change is essential. Design features include: "twin-shoe" self-lubricating contacts; molded ceramic base and core featuring high density, low porosity and high dielectric strength; vitrohm vitreous enamel permanently bonding base and core.

Ward Leonard Electric Co., Mount Vernon, N. Y.

IT PAYS TO HAVE GOOD CONNECTIONS

HUBBELL

ANNOUNCING
the new A.C.

presSwitch

Quality... you can put your finger on

Introducing "Presswitch," the revolutionary new Hubbell press-type A.C. switch . . . a press,it's on; a press,it's off . . . the smoothest, most convenient and most efficient A.C. switch in Hubbell's famous switch family. "Presswitch" responds to the gentlest press or touch of the finger or nudge of the elbow. It is as much at home in a factory as in a living room. Its attractive styling blends with any interior and its rugged, precision molded construction represents a new standard of durability and dependable operation.

Now available at your nearest Hubbell distributor in single pole, double pole, three-way and four-way.

HARVEY HUBBELL, INC.

HIGHEST QUALITY
WIRING DEVICES • MACHINE SCREWS

Dept. C-1 BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE OFFICE AND WAREHOUSE LOCATIONS

Bridgeport 2, Connecticut
State and Bostwick Streets

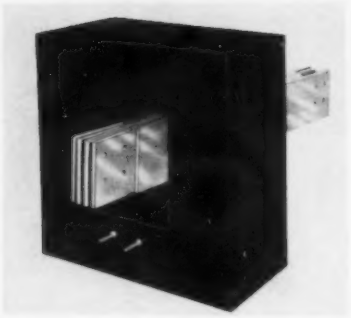
Chicago 7, Illinois
37 South Sangamon Street

Los Angeles 12, California
103 North Santa Fe Avenue

San Francisco, California
1675 Hudson Avenue

Dallas 7, Texas
1111 Dragon Street

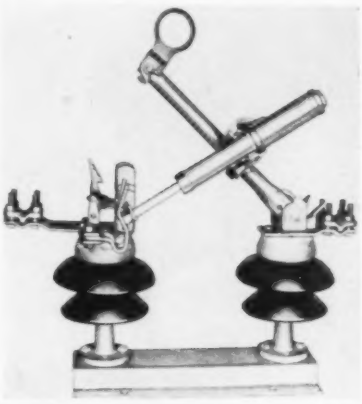
IN CANADA:
Scarborough, Ontario
1160 Birchmount Road



Transducer **(36)**

DC current transducer measures high dc currents. Current ranges vary from 500 to 500,000 amps with an accuracy of 0.5 to 1.0%. All items with the exception of the ac current transformer are housed in a metal cabinet 8-in. high by 14-in. wide by 8-in. deep. AC current transformer consists of two saturable core reactors which are magnetically coupled to the dc bus, producing an ac signal that is linearly proportional to the magnitude of the dc. Data sheet TDC-1 available.

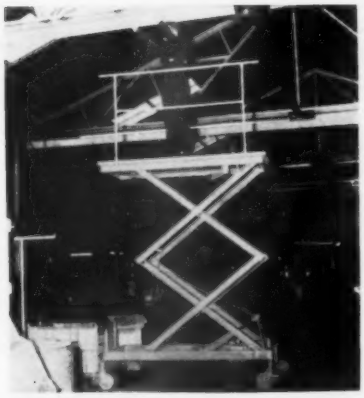
Rapid Electric Co., 2881 *Middletown Road, New York* 61, *N. Y.*



Load Interrupter **(37)**

A new expulsion-type load interrupter, designated Type PLA, for mounting on hook-stick operated or horizontal-break switches. Interrupters are rated 600 amps at 15 kv and are applicable to 7.5- or 15-kv systems. Features include an internal actuating spring which provides contact separation speed independent of switch operating speed, and recocking action near the end of the opening cycles. Interrupter units may be removed for inspection or maintenance while switches are closed and energized.

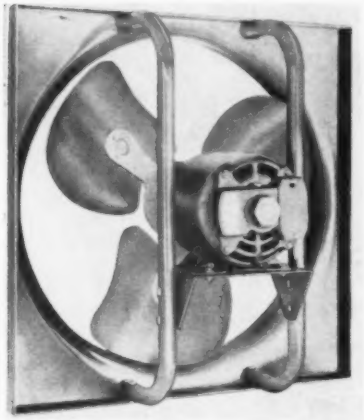
Line Material Industries, Milwaukee 1, *Wis.*



Hydraulic Scaffold (38)

A new portable hydraulic scaffold called "Sky Witch" will lift 2000 lbs up 17 ft. Suitable for installation and maintenance of overhead equipment in factories and institutions, and on power lines and bridges. Power can be supplied from electrical receptacle 110-volt ac or dc, automotive batteries, or gas driven generator. Dual controls on the rising platform and on the base afford safe, flexible operation. Restrictors in hydraulic system prevent sudden lowering due to mechanical or hydraulic failure.

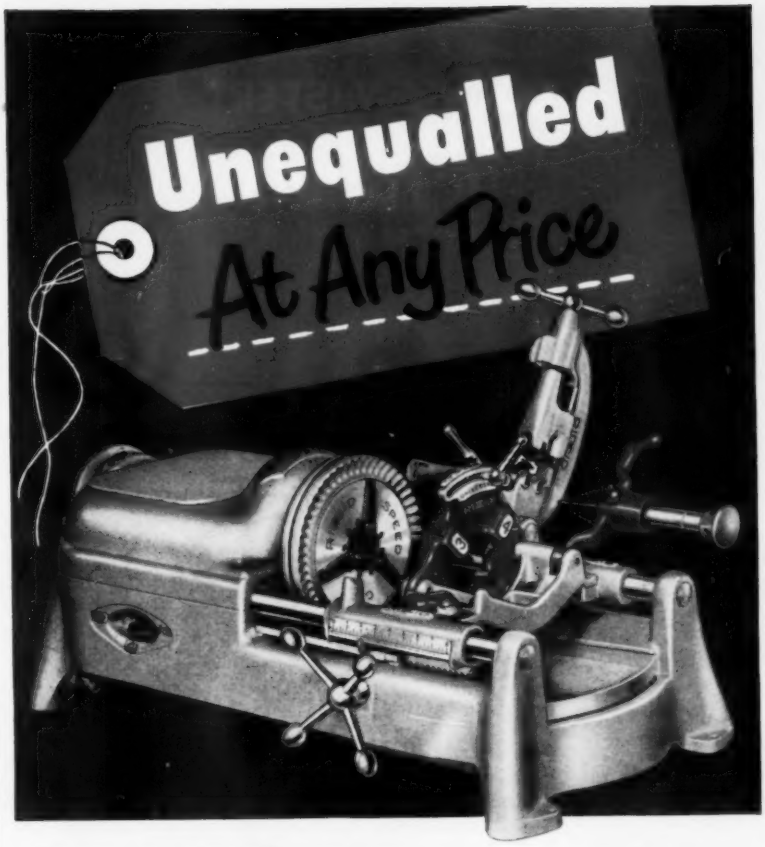
The Charles Machine Works Inc., 626 Birch St., Perry, Okla.



High Capacity Fans (39)

A new general ventilating fan, type "BA", has been announced featuring direct-drive sleeve bearing semi-enclosed motor, and true venturi orifice with square mounting panel. This unit has high capacity PFMA certified ratings. Also new is type "BG" utility exhaust fan which includes two-speed control and convenient outlet box.

Chelsea Fan & Blower Co., 639 South Ave., Plainfield, N. J.



RIDGID No. 535

Pipe & Bolt Threading Machine Complete with 1 Universal Die Head and 2 Sets of Dies, ½" to 2"...

Built like a machine tool, designed to thread, cut and ream conduit with speed and ease no other machine offers you. Compare its slip-proof Speed Chuck, front chucking, instant size-change right in carriage, and many other RIDGID features. It pays you to see and try this most-for-your-money 535 at your Supply House before you decide.

The Ridge Tool Company, Elyria, Ohio, U. S. A.

It's Self-Gripping

CHANNELLOCK®

No. 410

HEAVY-DUTY PLIER

• How's this for gripping power? You won't know your own strength 'til you grab hold with this heavy-duty, self-gripping plier. The Channellock No. 410 HEAVY-DUTY is actually a combination plier-wrench . . . and it will get into tight places you can't reach with a pipe wrench. A mighty handy, multi-purpose tool with four jaw adjustments up to 1-1/8".

ASK YOUR TOOL SUPPLIER FOR A CHANNELLOCK No. 410 HEAVY-DUTY PLIER

BE SURE IT'S A GENUINE CHANNELLOCK

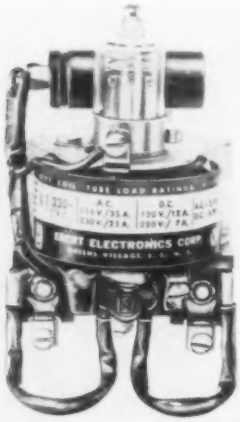
LOOK FOR THE TRADEMARK ON THE HANDLE

CHAMPION DeARMENT TOOL COMPANY • MEADVILLE, PENNSYLVANIA

Static Relay **(40)**

A static device serving the function of a voltage regulating relay on MLT-32 3-phase step voltage regulators rated 1000 kva and below. Bandwidth from 1½ to 6 volts and voltage level from 105 to 135 volts can be dialed on the control panel. Other control features of the MLT-32 regulators have been maintained: locking knobs, position indicator with operation counter and an integrating time delay relay.

General Electric Co., Schenectady 5, N. Y.



Relay **(41)**

A new series of full power SPST, 2PST, and 3PST time delay relays rated at 20, 35, and 60 amps, or up to 5 hp at 115 volts AC. Features hermetically sealed mercury-to-mercury snap action. Adjustable "make" delay periods are available factory pre-set in several ranges covering delays of from 3 to 120 seconds; delay settings may be shifted at any time. Available for ac or dc service.

Ebert Electronics Corp., 212-26 Jamaica Ave., Queens Village 28, N. Y.

Transistor P A System (42)

A new industrial, dual channel, voice communication system for use in noisy areas. Telephone type handset stations and loudspeaker assemblies connected by two pairs of No. 18 unshielded wire plus a 115-volt ac power source. Handset stations and speaker assemblies each has its own "plug-in" printed circuit transistor amplifier. Indoor units are dust tight and outdoor units are weatherproof. Basic system allows two simultaneous conversations, one on each channel, both of which are common talking.

Gai-Tronics Corp., Reading, Pa.

Flexible Conduit (43)

"Sealflex" black liquid-tite synthetic covered flexible conduit for protection against liquid and moisture vapor conditions. Conduit has an extra heavy galvanized steel core with a copper wire positive ground and an overall black polyvinyl chloride plastic cover of a grade resistant to the action of moisture, oils, greases and many chemicals. Available in ⅜-, ½-, ¾-, 1-, and 1¼-in. electrical conduit trade sizes. UL approved.

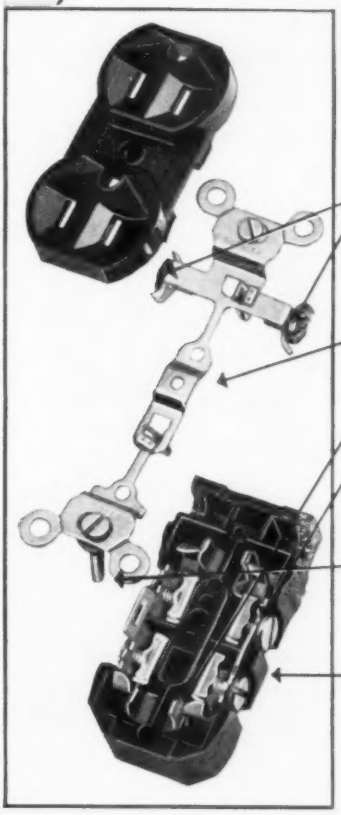
Universal Metal Hose Co., 2133 S. Kedzie Ave., Chicago 23, Ill.

Timer (44)

New model "FA51-O" fan control timer fits single standard outlet box; automatically shuts off electrical equipment at any preselected time up to 20 hrs. Can be used to control attic fans, yard lights, and porch lights. Timer wall plate measures 2¾ by 4½ by 13/16-in. Rated at ¾ hp, 120-volt, 60 cycle, with time mechanism completely enclosed. UL listed.

Paragon Electric Co., Two Rivers, Wis.

This symbol on
Specification Grade G-E Wiring Devices
assures you of extra features for handy installation and long, satisfactory service



The GE4065 ASA & NEMA standard grounding outlet is a good example of the high quality you get in *all* G-E specification grade wiring devices

Has convenient grounding terminals on each side, to permit easy carry-through of grounding wire. Mounting strap connected to grounding terminal for automatic grounding on conduit or armored cable circuits.

Through strap, with heavy molded base and face assembled to it, won't bend out of position in mounting.

Double-wipe contacts.

Break-off can be removed with screwdriver, permitting outlet to be wired as: (1) Common feed, common ground (2) Separate feed, common ground, or (3) Separate feed, separate ground.

Plaster-cleaning mounting screws thread easily into clean or plaster-clogged box ears, and are extra-long (⅞") to simplify mounting when box is set deep. Plated screws are held in strap by fiber washers . . . all ready for mounting.

Back-wiring pressure terminals wire easily with Nos. 14, 12 or 10 Awg wire.

ASA & NEMA standard, 125V-15A rating. Also available (GE4067) with 250V-15A rating. Ivory, and brown. Listed by U.L., meets Federal, ASA and REA specifications.

General Electric Specification Grade Wiring Devices contribute to the best reputation of the man who recommends or uses them. Choose from the high-quality G-E line for easier, more profitable, more dependable wiring installations. General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

Progress Is Our Most Important Product

GENERAL ELECTRIC

MOLDED CASE CIRCUIT BREAKERS

WHY A MOLDED CASE CIRCUIT BREAKER?

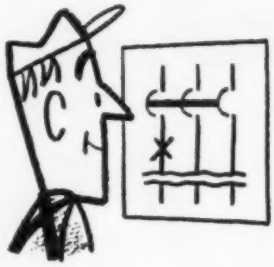
THERE ARE AT LEAST 10 GOOD REASONS

1. SAFETY TO PERSONNEL

Completely enclosed terminals on I-T-E Molded Case Circuit Breakers provide maximum safety to personnel, even when breaker enclosure covers are open. And I-T-E Circuit Breakers cannot be manually held closed against a short, because they open instantly.

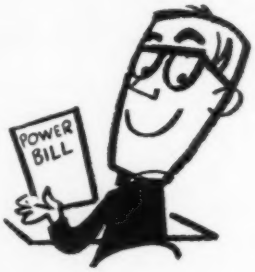
5. NO REPLACEMENT OR MAINTENANCE COSTS

Circuit breakers do not require replacement parts or fuses—the first cost is the last. Nor do they require periodic checkup and maintenance, such as tightening of joints, cleaning of contacts, and occasional tightening of removable fuse links.



6. PREVENTS SINGLE PHASING

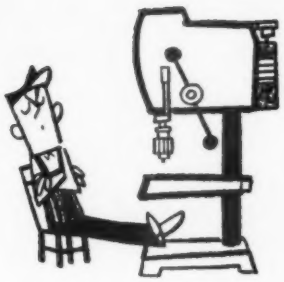
No matter which pole or poles of an I-T-E Molded Case Circuit Breaker are affected by an overload or short circuit, all contacts open simultaneously. The combination of a circuit breaker and properly applied motor controller is an unbeatable combination to guard against single phasing.



7. LOW POWER LOSS

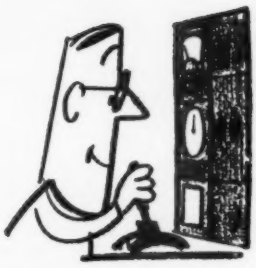
High contact pressure, silver alloy contacts, and electrically welded connections in I-T-E Molded Case Circuit Breakers assure minimum watt loss. Year after year, a circuit breaker can save you lots of money in power costs.

For detailed information, see your authorized I-T-E distributor or write to I-T-E Circuit Breaker Co., Small Air Circuit Breaker Division, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.



2. REDUCES PRODUCTION DOWNTIME

I-T-E Circuit Breakers save dollars by eliminating lost man-hours, lost machine-hours, and lost production. Anyone can tell a tripped breaker at a glance—no need to locate and replace blown fuses. Once a fault has been cleared, it is only necessary to reset the breaker.

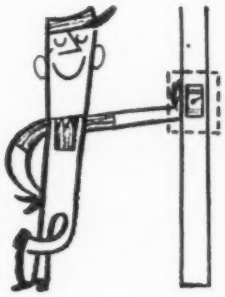


3. UNIFORMITY OF OPERATION

All I-T-E Molded Case Circuit Breakers are factory set and tested. At least two tests are made at 200% continuous current rating to make certain breakers trip within the proper interval of time.

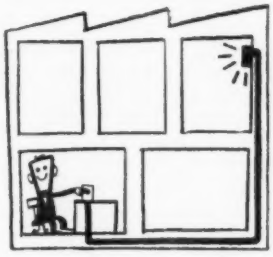
4. COMPLETELY TAMPERPROOF

Breaker tripping mechanisms are sealed—calibrations cannot be altered. And circuit breakers eliminate the dangerous possibility of inserting incorrect rated fuses.



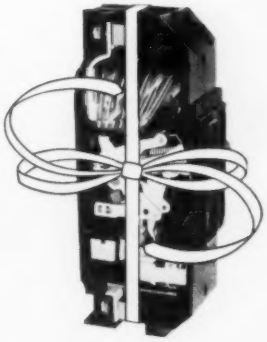
8. SAVES MOUNTING SPACE

I-T-E Molded Case Circuit Breakers are compact. Space means money, and the relative compactness of I-T-E Circuit Breakers is another reason why circuit breakers mean greater economy for you. For example, a 600 amp enclosed circuit breaker is 6 in. shorter, 7 in. narrower, and 2 to 3 in. shallower than a comparable rated fusible switch.



9. VERSATILITY IN APPLICATION

A very wide range of special attachments and enclosures are available. This broadens the application of circuit breakers to meet all of industry's diversified requirements. For instance, remote tripping of breakers or remote visual or audible signals of breaker operation are available for special applications. There are I-T-E Molded Case Circuit Breakers to meet your requirements with maximum economy and safety.

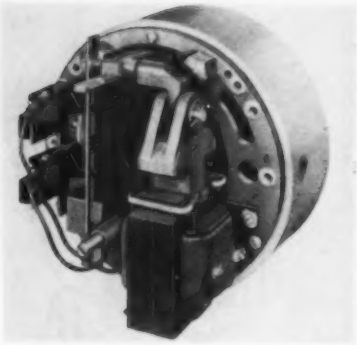


10. UNDIVIDED RESPONSIBILITY

I-T-E Circuit Breakers are manufactured, tested and sold as a unit. Fusible switches and fuses are not. When you buy an I-T-E Molded Case Circuit Breaker, you are buying lifetime assurance of consistent and coordinated protection.

I-T-E CIRCUIT BREAKER COMPANY

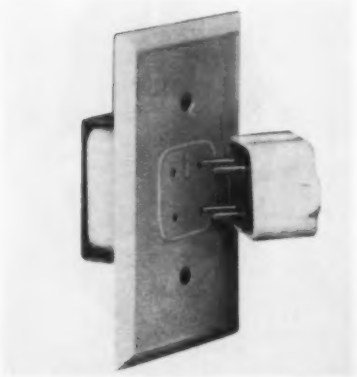
PHILADELPHIA, PENNSYLVANIA



Magnetic Brake (45)

New dc shunt-wound brake of the Style HT70 series, is available in standard and dust-tight waterproof enclosures. Torque ratings of from 10 lb-ft through 105 lb-ft. Model retains single-point adjustment for lining wear, visual indication of lining wear, and manual release with automatic reset.

Stearns Electric Corp., 120 *North Broadway, Milwaukee* 2, *Wis.*



Plug and Jack Set (46)

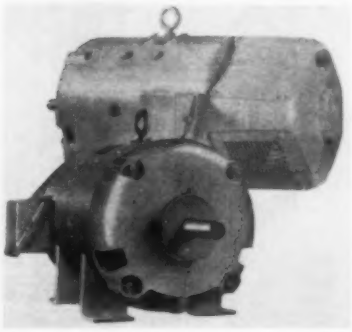
New standard 4-prong wall plug and jack for flush or non-flush mounting is now available. S.E. 404 jack has 4 spring-tensioned jack holes; S.E. 44 bracket has holes for conduit box mounting, and S.E. 19B wall plate completes assembly. S.E. 283 plug has two ears to facilitate removal from jack.

Suttle Equipment Co., 135 *S. La Salle St., Chicago* 3, *Ill.*

Regulators (47)

Six new higher-capacity ratings have been added to the ML-32 line of step-type feeder voltage regulators. New substation ratings are 125 and 167 kva in the 2,500 and 5,000-volt classes, 250 kva in the 7,260-volt class and 138 kva in the 13,800-volt class. At reduced regulation range, 2,500-volt units, 75 and 100 kva, can now carry 480 amps or 160% of rated current, whichever is less.

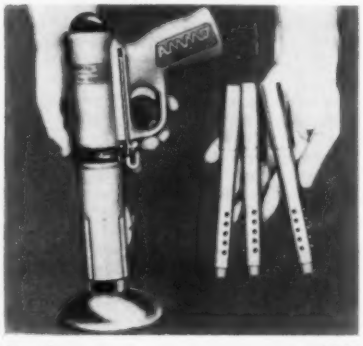
General Electric Co., Schenectady 5, *N. Y.*



Motors and Generators (48)

A new line of dc motors and generators with frame sizes from 80 through 586. They are interchangeable, rating for rating, with corresponding NEMA ac induction motors. Motor line ranges from ½ to 200 hp, ¾ to 200 kw, operate at a continuous 60°C rise, and are equipped with Class B insulation. DC Bulletin No. SB-182 is available.

Marathon Electric Mfg. Corp., Wausau, Wis.



Studgun (49)

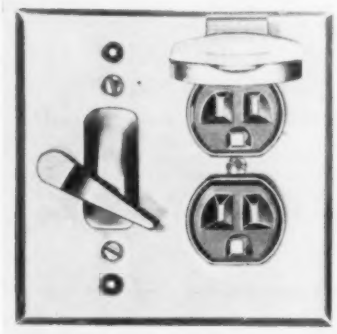
A new powder-actuated studgun that will handle all types of fastening requirements and drive all sizes of pins including ⅜-in. A special safety guard prevents firing unless tool is in position and pressed firmly against work surface. Trigger action is smooth and positive and barrels are designed for fast changeover.

Ammo Products, Inc., 1100-20*th St., N.W., Washington, D. C.*

Mercury Underwater Fixture (50)

An improvement in underwater lighting is achieved with the new type "SPS" swimming pool floodlight. It uses a 400-watt mercury vapor lamp, which is a blue-green color. Unit has cast-bronze porthole ring and Alzak aluminum reflector. In pools with tile facing, a square cast-bronze mask is used to cover the edge of the tile.

Crouse-Hinds Co., Wolf & Seventh Sts., Syracuse, N. Y.



Switch-Receptacle (51)

This 2-gang unit features weatherproof snap switch and duplex U-ground receptacle with hinged cover. Switch is "T" rated and receptacle rated 15 amps, 125-250 volts, UL approved. Plate is made of .040 brass with sprayed aluminum finish; cover made of cast aluminum with self sealing rubber insert. Meets all REA specs.

Perfect-Line Manufacturing Corp., Hicksville, N. Y.

Temperature Control (52)

Explosion-proof dual switch temperature control, type "E98A", is a sensitive remote bulb temperature control designed for use in hazardous locations. Two separate switches permit switch action above or below the set point, control of independent circuits, and flexibility of switching arrangement. Settings are made by rotating a single knob and pointer over a calibrated dial. Thermal system consists of a bulb, capillary, and bellows filled with temperature sensitive liquid; bellows expands or contracts thus actuating a snap-action switch. All switches are single pole, NO, NC, and DT with neutral position, rated 15 amps at 115 or 230 volts ac; and suitable for 180°F ambient.

United Electrical Controls Co., 79 *School St., Watertown* 72, *Mass.*

Products that Prove

$LATER MEAN$ BU$INE$$

Place your order with Slater today!

Wholesaler or contractor . . . you're 'way ahead with the finest feature-packed switches and receptacles in the industry! Write for the new streamlined Slater Catalog . . . over three hundred top quality items to make your job easier . . . more profitable!

New Comparative Catalog Number Guide sent on request.

Slater

SLATER ELECTRIC & MFG. CO., INC. GLEN COVE, L.I. NEW YORK, ORIOLE 6-1100

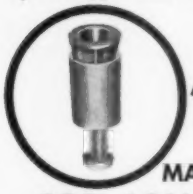
USE

USE

ANCHORS and FASTENERS for ELECTRICAL INSTALLATIONS

"LOKTITE" TOGGLE BOLT for HOLLOW WALLS

Assures a secure installation to all hollow wall material. Spring action opens toggle head when inserted.



"KORKER" with MACHINE SCREW FOR SOLID WALLS

Permits fast shallow hole fastening.

U. S. E. anchors and fasteners are made to accurate specifications assuring ease of installation.

Always specify U.S.E. products when ordering from your, Electrical or Hardware supplier.

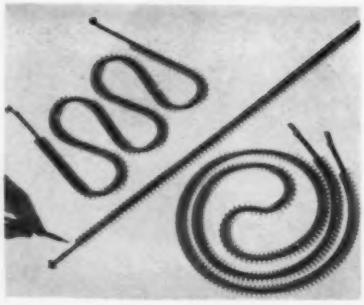
ORDER THROUGH YOUR WHOLESALER

USE

MASONRY ANCHORING, FASTENING, DRILLING AND ALLIED PRODUCTS

U. S. EXPANSION BOLT CO.

YORK, PA. DEPT. EC-4



Finned Tubular Heaters (53)

New slim, finned tubular heating element for forced convection air heating. Called "Chromalox Microfin" the small-mass heater provides rapid heat-up, but has the advantage of totally enclosed and insulated construction. Elements are ¼-in. in diameter and fins are furnace brazed to provide homogeneous construction. Suited for air ducts, blower space-heaters, and industrial processes requiring heated air blasts such as ovens and dryers. Watt density of 80 watts per square in. on steel or alloy sheath. Alloy construction available for installations in which corrosive atmospheres are present. Standard lengths range from 5½ to 47½ in.; voltages are 120 and 240, with wattages from 525 to 3000.

Edwin L. Wiegand Co., 7500 *Thomas Blvd., Pittsburgh* 8, *Pa.*

Cable Ladder (54)

Cable ladder sections for the support of interlocked armored cable. Available in 12-ft lengths and various widths. Made of "Z" shaped galvanized steel sides with slotted rungs spaced from 6- to 18-in. intervals as cable requires. Ladder sections can be connected by pin type couplers to cable trough sections. Accessories and fittings available for making turns and bends.

T. J. Cope Division, Rome Cable Corporation, Collegeville, Pa.

Transformer (55)

New dry type transformers with noise level below 45 DB is now available in sizes from 50 kva single-phase to 150 kva 3-phase for low noise level requirements in commercial buildings. Tested in accordance with NEMA Standard ST 1-4.00. Noise reduction is improved by eliminating the case cover, a major source of noise.

General Electric Co., Schenectady 5, *N. Y.*

Automatic Door Operator (56)

New door opener is contained in a single unit. Installation consists of attaching the door operator to the door and making electrical connections. The ECA door operator is readily applied to existing doors as well as new construction. Door operators are supplied with either mat switches or photoelectric controls. Door opens, stays open until passage is cleared, then closes automatically. Is adaptable for entrances, exits of all types, service doors, and industrial uses. Bulletin PD 568 available.

Electronics Corp. of America, One Memorial Drive, Cambridge 42, *Mass.*

Cable Support Fittings (57)

Two new adjustable splice plates made for use with cable support systems change the direction of cable support travel. Plates lock in place with a squeeze on a pair of pliers to actuate the splice lock. Plates are available in aluminum, steel or Armco aluminized steel, Type 2.

The Chalfant Products Co., Inc., 11525 *Madison Ave., Cleveland* 2, *Ohio.*

Clamp (58)

Two new lines of hot line clamps, "HL" open thread clamp, and "HLP" enclosed thread spring compensated clamp, are available in aluminum or plated aluminum. Main and tap contacts are on the same casting, giving a low resistance current path. Features large extended "duck-bill" upper contact and deep seat design for ease of installation. HLP line consists of three clamps which take all cable sizes between No. 6 solid and 636 MCM ACSR; type HL consists of five clamps for sizes between No. 8 and 1431 MCM ACSR.

Anderson Electric Corp., Birmingham 1, *Ala.*

Wire Connectors (59)

Three sizes of solderless wire connectors. Stripped wire ends are inserted into the connector. An inner helical spring grips, guides, tightens wires into a proper splice. They are made of bakelite and are weatherproof and chemical resistant. UL listed.

Eagle Electric Mfg. Co., Inc., 23-10 *Bridge Plaza South, Long Island City* 1, *N. Y.*

Baseboard Heaters (60)

"Thrift-Trim" Heetaires is a new line of individual and complete system baseboard heaters. Features two sheathed elements, 75 finned heat exchangers for every 2 ft (450 square in. per lineal ft), double baffle air flow, built-in automatic furnace-type thermostat control, and low surface temperature (250 watts per ft). Produced in lengths of 24-, 48-, 60-, 72-, and 96-in.; in wattages from 500 to 3000. Single unit will produce 3000 watts.

Markel Electric Products, Inc. and La Salle Products, Inc., Buffalo, N. Y.

Plastic Molding (61)

A new plastic molding named "Kover-Gard" or "K-G" has been developed for covering ground wires, street lighting conductors, control circuit wiring, and many other applications where wiring needs protection. Made of high impact shock resistant plastic in popular sizes. Is flexible enough to conform to normal bending without breaking. Is water and fire resistant, rot-proof, and impervious to the action of plant and animal life. Furnished in 8-ft lengths.

The Fanner Manufacturing Co., Brookside Park, Cleveland 9, Ohio.

Protective Device (62)

New electronic Amp-Trap called "Form 101" protects delicate electronic instrumentation, devices and circuitry. Anticipates and prevents the rise of fault currents to high destructive maximums; becomes current-limiting at four times its normal current. Available in a wide variety of capacities and sizes for use in 65-130- and 250-volt circuits. Can be connected directly into circuits where the short-circuit current is up to 100,000 amps.

The Chase-Shawmut Co., Merrimac St., Newburyport, Mass.

Textile Motors (63)

A complete line of textile motors that feature enclosed, non-ventilated construction. Newest addition is a 4-pole, 5 hp rating. The TENV motors are designed for such applications as spinning and roving frames, and warping and twisting machines. The enclosed, non-ventilated design minimizes fire hazards by preventing lint from coming into contact with the windings.

General Electric Co., Schenectady 5, N. Y.

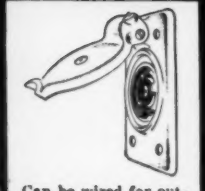
new!

3-wire 30 amp LEV-O-LOCK Flush Outlet and Cap

The complete LEV-O-LOCK line of Specification (5000) Grade devices provides safe, dependable connections under severest conditions of vibration, motion or accidental pull-out.

SPECIFICATION GRADE
No. 5181
Single Flush Outlet

SPECIFICATION GRADE
No. 5180
Armored Cap with slidable cord clamp that adjusts to varied-size cords



Can be wired for outdoor use in FS and FD type boxes accommodating 1⅝" weatherproof hinged plate or for Industrial use in Standard switch boxes.

PUSH-TURN-IT'S LEV-O-LOCKED

For Industrial Plants, Office Equipment, Trailer Camps, Ships, Dryers in the Home, or Wherever the Code Requires 30 Amp Service. Here is the first 30 Amp outlet to fit standard outlet box covers.

Meet Underwriters' Laboratories and Federal Specifications

your best jobs are done with . . .
LEVITON MANUFACTURING COMPANY, INC.
Brooklyn 22, N. Y.

LEVITON

Samples on request

Chicago • Los Angeles • Leviton (Canada) Limited, Montreal

For your wire needs, contact our subsidiary AMERICAN INSULATED WIRE CORP.

Westinghouse Life-Line "A" motors save $200 a year in rewinding costs alone

... at Rumford Chemical Works, Rumford, R.I.

Westinghouse motors are reliable for 24-hour, 7-day week operation in sulphuric acid manufacture

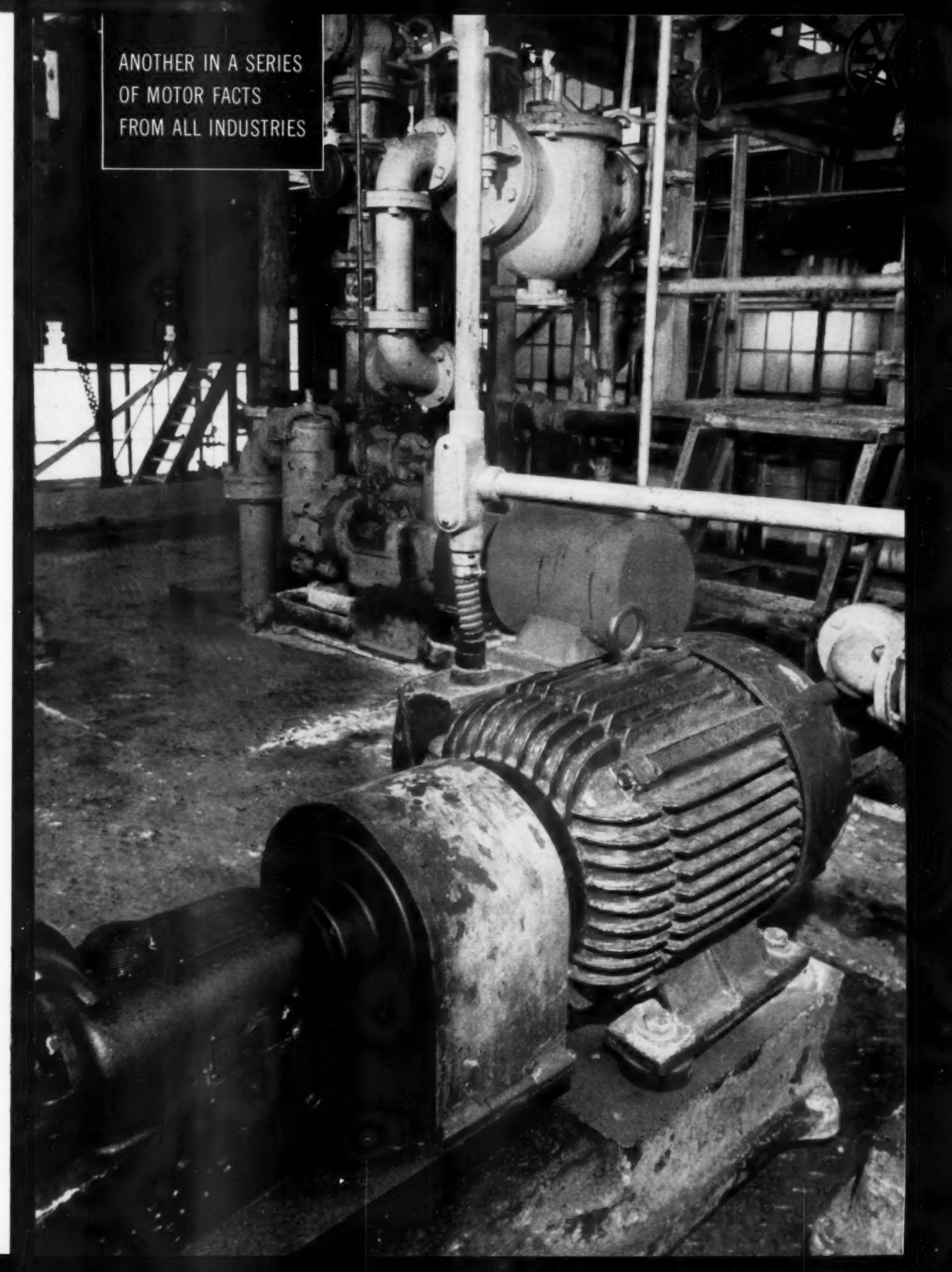
Mr. Harvey with a 7½-hp Life-Line "A" which drives a sulphuric acid pump in the process at Rumford. This totally enclosed unit has been in operation for over two years.

"In the four years we have used Life-Line® "A" motors, we have never stopped the process because of a faulty motor," reports Mr. John E. Harvey, Plant Engineer at Rumford Chemical Works.

Before installing Life-Line "A" motors, the Rumford Chemical Works had to rewind, on an average, two motors a year at a cost of $100.00 per motor . . . always because the corrosive atmosphere put them out of operation. "We no longer have this problem," reports Mr. Harvey, "since the totally enclosed Life-Line "A" motors give us reliable, continuous operation without fear of damage from spilled acid which could come from leaks or breaks in the pipes."

POWER-UP with Life-Line "A" motors designed for modern industry's needs. For more facts, call your Westinghouse sales engineer or distributor. Or write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania. J-22059-R

YOU CAN BE SURE... IF IT'S Westinghouse


ANOTHER IN A SERIES
OF MOTOR FACTS
FROM ALL INDUSTRIES

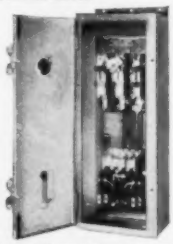
CONTRACTORS

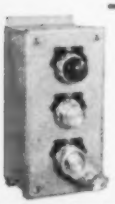
REDUCE COST AND SPACE REQUIREMENTS WITH FURNAS ELECTRIC CONTROLS

Furnas Electric offers the RIGHT control for every job. Enjoy cost and space advantages by choosing the control designed for the motor.

Only Furnas provides a choice of 10 starters through Size 4, instead of the usual 5, to match the applications from 1 hp to 100 hp. All are UL listed. Exclusive "In-between" sizes give additional cost and space advantages.

Combination Starters—a single mounting plate containing magnetic starter and disconnect for economical installation. Combination unit is used for all types of enclosures as well as an open unit for panel mounting. All Furnas Combination Starter enclosures feature external mounting feet for simplicity and accessibility.





Push Buttons for every need—Standard, Heavy-duty and Oil Tight. Choice of either front or back mounting. Furnas standardization and interchangeability mean more variations with fewer parts. Complete accessory line.

Drum Controllers

Pressure Switches

Limit Switches

Foot Switches

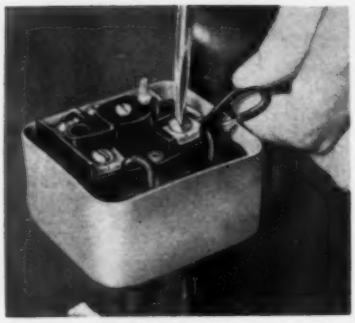
For full information write for Catalog 5800, 1067 McKee St., Batavia, Illinois A38

FURNAS

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES



Pressure Switch (64)

New series "PS" pressure switch features pressure connectors, top accessible wiring terminals, no-drift pressure settings, and four enclosure styles. Rated 85 lbs maximum capacity, 1 hp, 110-220 volts single and 3-phase. Useful for water pumps, low pressure air compressors, paint sprayers, and other air or water systems requiring automatic control of pressure between preset limits. Catalog 5516B available.

Furnas Electric Co., 1067 McKee St., Batavia, Ill.

Zipper Tubing (65)

"Zippduct" is an abrasion-resistant covering for wires and cables. It is stapled into position and wires zipped in, other conductors added as work progresses. Can be permanently sealed, insuring a rodent repellent cable covering that has high dielectric strength. Can be unzipped for inspection and rework purposes until permanently fused with sealer. Available in sizes from $\frac{3}{8}$-in. up, in increments of $\frac{1}{8}$-in. (I.D.), and in lengths of 25 ft.

The Zippertubing Co., 752 S. San Pedro St., Los Angeles 14, Calif.

Hand Lamps (66)

Two new "Big Beam" electric hand lamps feature sealed-beam heads operating on two standard 6-volt lantern batteries. Model 264 is a combination white light and red flasher type with thermal flasher unit contained in the bulb. Flasher arm is adjustable for use in either an upright or horizontal position. Two separate switches operate the flasher and white light independently, covered with a rubber boot to prevent water, moisture and dirt particles from entering switch contacts.

U-C-Lite Mfg. Co., 1050 West Hubbard St., Chicago 22, Ill.

Catalogs & Bulletins

(67) MERCURY LAMPS. 6-page technical reference LS-103 provides comprehensive information on design and operating characteristics of complete line of mercury lamps and transformers. General Electric Co.

(68) FOOTSWITCHES, more than 75 different models of all types, are listed with full specifications: contact type, stage, pole, throw, phase, rating, size, and weight. Catalog 57. Linemaster Switch Corp.

(69) EXPANSION BOLT which expands as it is tightened without the use of expansion sleeves, shields or butterfly ends is described in new catalog sheet. Kirel Inc.

(70) MERCURY VAPOR FLOODLIGHTING. Bulletin 640, 18 pages, contains latest information on operating characteristics and operating economies of available lamps, plus section on how to select ballasts. Pyle-National Co.

(71) DISTRIBUTION CENTER. GEA-6619, 16 pages, contains complete data on new dry-type integral distribution center for industrial plants, warehouses, schools and libraries, office and commercial buildings, railroad and airport terminals, hospitals and laboratories. General Electric Co.

(72) FAN MOTORS for air conditioners. 8-page publication GEA-6533A describes shaded-pole and permanent-split capacitor type fan motors for room air conditioners. General Electric Co.

(73) INDUCTION MOTORS. 8-page bulletin 1900 describes new Syncro-Spede synchronous induction motor in ratings from 1 to 100 hp for such uses as high-frequency drives, precise timing, metering and recording devices, constant speed conveyor drives, and adjustable-frequency multimotor systems. Louis Allis Co.

(74) ELECTRIC TIMERS. Miniature timer application story book is a small encyclopedia of practical uses for modern time control. Form 5820-T. Paragon Electric Co.

(75) ELECTRIC HEATING system planning. 8-page computation manual provides information on rapid method of computing electric heating requirements for typical resi-

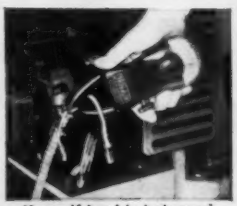
don't guess! AMPROBE IT!

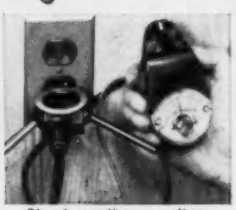
AMPROBE RS-1
only $39.85
with Rotary Scales, has 4 current ranges 0-5/15/40/100 and 2 volt ranges 0-150/600.

There's nothing like an AMPROBE for fast and profitable trouble-shooting. Wrap-around feature makes it simple to read current without shutdowns. Multiple current and voltage scales permit you to test most everything in sight with a single instrument.

There's an AMPROBE for every job, every budget... from 10 amps and 250 volts to 1200 amps and 600 volts AC. Prices from $19.85 to $67.50—so you can't afford *not* to own one. See them at your jobber today. Pyramid Instrument Corp., Lynbrook, N. Y. Manufacturers of famous REMCON simplified low-voltage switching devices. In Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto, Canada.

13 models to make your work easier, faster, surer


Know if load is balanced


Check appliance voltage at receptacle

Take current readings without shutdowns

TOUGH PROBLEM *Licked!*

2-Point and 3-Point "PRA" Primary Resistor Starters at Sears Oil Co., one of nation's largest independent oil and gasoline distributors.

by New "PRA" REDUCED VOLTAGE STARTERS and *on-the-Job Service*

The Sears Oil Company, Rome, N.Y., had to control and protect large horsepower motors for pumps providing a flow into and out of storage tanks at its multi-million dollar deep water storage depot. Local power company regulations made reduced starting voltage a "MUST." Arrow-Hart was called in to solve this problem. Working with John Reed, local electrical contractor, Arrow-Hart field engineers came up with the answer — new Arrow-Hart Type "PRA" Primary Resistor Reduced Voltage Starters. Providing the necessary control and protection, they also met all local regulations governing low-voltage starting.

Small, light weight "PRA" Motor Controls, with "RA" Magnetic Starters, provide dependable, economical control. "Ribflex"* and "Edgeohm"* resistors assure correct starting current limitations. Overload relays are A-H bi-metal type. Starters can be wired for 2-wire automatic control or 3-wire push button control.

Whether your need is the *right* product for the job, or on-the-job assistance — or both — Arrow-Hart can serve you.

Write for more data on "PRA" Resistor Starters and complete information on A-H Sales Engineering Service to the Arrow-Hart & Hegeman Electric Co., Dept. ECM, 103 Hawthorn St., Hartford 6, Conn.

* TRADE MARK OF WARD LEONARD ELECTRIC CO.

ARROW AH HART

Quality since 1890

MOTOR CONTROLS • ENCLOSED SWITCHES
APPLIANCE SWITCHES • WIRING DEVICES

ARROW AH HART

dential installations, including a description of equipment available and definitions of heating terms. Markel Electric Products, Inc.

(76) DISTRIBUTION EQUIPMENT. New 1958 catalog, 72 pages, gives complete product and ordering information on safety switches, fusible service, circuit breakers, load centers, and meter mounting equipment. Murray Mfg. Corp.

(77) OUTDOOR LIGHTING fixtures. 4-page bulletin S158 gives construction details, light distribution curves, specifications and suggested typical uses for Lumi-Post and Lumi-Pend fixtures. Silvray Lighting, Inc.

(78) ROTARY SELECTOR SWITCHES. Expanded 4-page data sheet 86b covers complete standard line, plus information on new sealed subminiature assemblies. Photos, dimensions, and electrical ratings are included. Micro Switch.

(79) CONTROL DEVICES catalog. GEC-1260C, 88 pages, covers complete line of controls manufactured by General Purpose Control Dept. Information is included on motor starters through 200 hp, contactors, relays, solenoids, limit switches, pushbuttons and pilot devices. General Electric Co.

(80) LIGHTING STANDARDS of aluminum for streets, highways, bridges, shopping centers, stadiums, etc., are described in new 16-page catalog with complete engineering data and illustrations. Kerrigan Iron Works, Inc.

(81) FLUORESCENT LUMINAIRES. New brochure describes 2- by 4-ft lighting unit for commercial applications, available with either plastic louvers or diffusing panels. Smoot-Holman Co.

(82) FAN AND BLOWER MOTORS. GEA-6134B, 12 pages, contains design, dimension, rating, performance, and application data on shaded pole motors for such applications as window, ventilator and condenser fans; domestic appliances, and unit heaters. General Electric Co.

(83) TV OUTLETS. New instruction manual for electrical contractors shows step-by-step procedure for wiring a residence with plug-in type TV wall outlets. TeVco Insulated Wire.

(84) LIGHTING FIXTURES for commercial and residential applications. 40-page catalog lists over 500 contemporary fixtures, including a

graphic reproduction of every unit manufactured. EJS Lighting Corp.

(85) WIRE AND CABLE. 6-page illustrated brochure presents detailed descriptive information on Turbo wire and cable line, plus an outline of various multiconductor cables available. William Brand & Co., Inc.

(86) ENCLOSED SWITCHES. Data Sheet 145 describes new housings for enclosed switches, detailing five different actuator designs. Micro Switch.

(87) TRANSFORMERS. Bulletin GEA-6108B, 32 pages, gives detailed information on repetitive manufacture medium transformers with RM-ASA ratings of 501-5000 kva, single phase, and 501-10,000 kva, 3-phase, 69 kv and below. General Electric Co.

(88) STREET LIGHTING LUMINAIRES. Two new bulletins describe complete line of luminaires available. Bulletin SL1 gives descriptions, photometric data, catalog numbers and prices on Line 3 incandescent luminaires; Bulletin SL6 includes application and ordering information on deep-globe, shallow-globe, floodlight, delta, and vee fluorescent units. Line Material Industries, McGraw-Edison Co.

(89) DRY-TYPE TRANSFORMERS. GED-3424, 8 pages, gives seven important guides in selecting and installing transformers in commercial building applications where quiet installation is necessary. General Electric Co.

(90) CABLE SUPPORT SYSTEMS including cable trough, ladder, channel, and Rak-it supports and accessories are described with dimensional detail sheets in new 60-page loose-leaf catalog. In addition to standard galvanized steel line, the catalog also describes aluminum trough, ladder and channel. T. J. Cope Div., Rome Cable Corp.

(91) SILICON RECTIFIERS. Bulletin GEC-1485, 4 pages, describes silicon power conversion units designed for general purpose industrial and commercial applications including power supply for cranes, elevators, machine tools and other applications requiring 250-volt dc current up to 600 kw. General Electric Co.

(92) BRUSHES of carbon and graphite for rotating electrical machinery are described and illustrated in new 12-page, two-color bulletin. Data for brush selection includes contact

ARROW AH HART

ARROW-HART

LOUVRE LIGHTS and Quiette TAP ACTION SWITCHES

Putting extra value into your wiring jobs is the best possible way to satisfy customers and build your reputation. And—whether you're wiring a home, office or institution—no value is more appreciated than added safety. So, new work or modernizing, install A-H Louvre Lights on your next wiring job. Located on stairways and landings, in halls and bedrooms . . . and everywhere that darkness is dangerous or disturbing . . . these devices provide a soft, subdued illumination. Available with Bakelite or metal plates in desired finishes.

And to insure the ultimate in electrical convenience, team Louvre Lights—and all the other incandescent or fluorescent lights and outlets on the job—with A-H Tap Action Quiette Switches. They operate without disturbing noise, and turn on *and* off with just a tap of finger-tip, hand or elbow. Available for 15 and 20 amp service, 120-277 volts ac, they provide a lifetime of extra value at *no* extra cost.

Write for free literature to The Arrow-Hart & Hegeman Electric Company, Dept. ECM, 103 Hawthorn Street, Hartford 6, Connecticut.

ARROW AH HART

Quality since 1890

MOTOR CONTROLS • ENCLOSED SWITCHES
APPLIANCE SWITCHES • WIRING DEVICES

ADVERTISEMENT

OKONITE cables

Electric power and control cables for lift bridge installed in unique manner... demanding Okocord engineered-to-last constructions

When Sverdrup & Parcel, one of America's leading architectural-engineering firms, designed the new Sidney Lanier Bridge in Brunswick, Georgia, for the Georgia State Highway Department, they discovered that they were faced with an electric cable problem that called for some imaginative thinking.

Briefly, the 250-foot lift span on the new structure was to be hoisted by synchronized motors in both towers which had to be linked with power and control cables. The question was—*where to locate the cables?*

Go over the bridge? Not only would that increase the loading on the bridge towers (to get proper sagging tensions) but aerial cables would materially detract from the clean, modern look of the handsome structure.

Go under the bridge? The river bed at this point consists of clean-swept shale with swift currents and reversing tidal effects. To lay cable on or under the bottom or in pipes would be extremely difficult and expensive, making replacement after normal service uneconomical.

Through the middle, then, was the best solution. Run the cables right through the span itself, a span that would be constantly moving up and down over a distance of 115 feet. To take up the cable slack, an ingenious system of sheaves and counterweights was designed for installation in the towers, just below roadway level. From these, the necessary cable would be payed out as the span rose . . . would be reeled in as the span descended.

Needed: *a strong, flexible, long-lived cable*

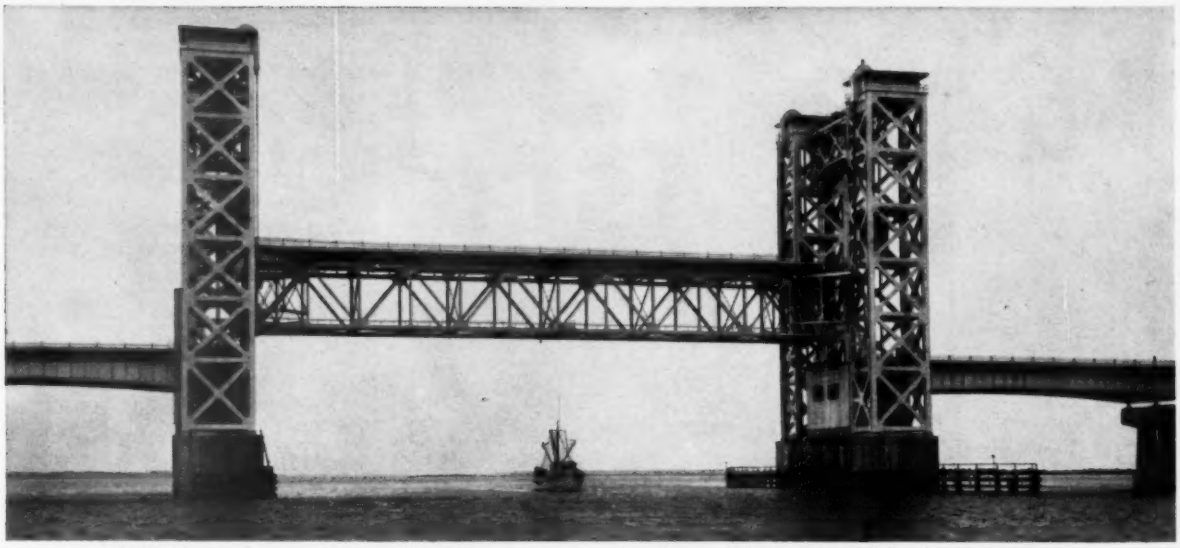
To make this plan work, however, unusual—perhaps unique—cable was needed. It had to have utmost flexibility to absorb the constant reeling and re-reeling under tension as the span moved up and down. It had to be unusually strong, for the height of the lift, combined with the counterweighting and wind load, would give a pull equivalent to 500 feet of cable. And, finally, it had to be capable of resisting repeated exposure to sunlight, heat, high humidity and corrosive salt spray.

←

2700 times a year these sheaves and counterweights go into action, paying out Okocord power and control cables as the bridge span is raised . . . reeling them in as the bridge is opened to traffic again. Designers specified Okocord to withstand the tension, sharp bends and constant flexing of this service.

ADVERTISEMENT

bring the big ones to life



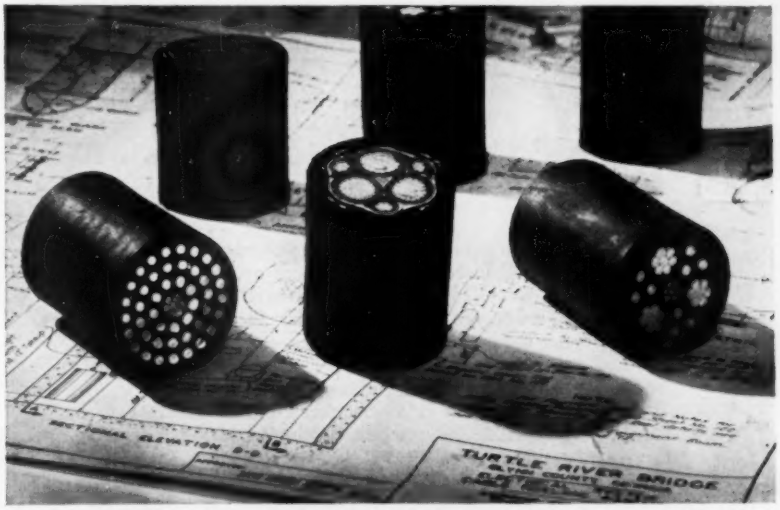
A 250-foot lift span, weighing well over one thousand tons, is raised by Okocord power and control cables to pass a shrimp boat under the new Sidney Lanier Bridge across Turtle River in Brunswick, Georgia. Designers, Sverdrup & Parcel; J. E. Greiner Co. and Associates, consultants; Georgia State Highway Department, supervisory engineers; electrical contractors, Harrison's Service of Brunswick. The unusual lifting mechanism is wired with more than ¾ of a mile of tough, flexible Okocord cables.

Why Okocord was picked

After various designs and estimates had been submitted, the Okocord constructions recommended by Okonite engineers got the nod. Interesting features of these cables were the steel rope core for reinforcing the multi-conductor control cable and the high moisture resistance of Okonite's insulation. Also, Okonite was able to point to at least two other Okocord installations in which similar conditions of environment, tension and mechanical action had been successfully met.

Installed more than a year ago, these Okocord cables have successfully brought the big Sidney Lanier Bridge to life. And engineers estimate that service life will at least equal a far more expensive submarine installation.

If your operation involves portable or flexible cable, write for Bulletin EC-1108 and find out how rugged, dependable Okocord can save time, replacement costs and down time losses. In fact, whatever your cable needs, when you talk to Okonite, you get unprejudiced recommendations, because Okonite, and *only* Okonite, makes cable by all four insulating methods: strip, dip, extrusion and taping. The Okonite Company, Passaic, New Jersey.



Vital links that control and power the bridge's motors, lights, alarms and gates are these three Okocord cables. Two lengths of each are used on either end of the span. Left to right are the 45-conductor, steel rope core cable for the intricate control system; the 6-conductor cable that powers the main drive motors; the 12-conductor, steel rope core cable that controls and powers the auxiliary drive motors. Each cable is protected against constant bending as well as environmental conditions by a tough, reinforced wall of mold-cured Okoprene.

where there's electrical power . . . there's **OKONITE CABLE**

5536

It will pay you to take a fresh LOOK at FASCO

You will find it pays in more ways than one to take another look at Fasco. You'll see a complete line of ventilating fans all with smart, "no-rust" aluminum grilles. You'll see ventilating fans that cut installation costs . . . the slimmest ventilating fan on the market . . . and a host of other features in this value-packed line designed and priced to reduce your costs.

So take a fresh look at all the fresh new Fasco features . . . they will convince you Fasco ventilating fans are your best buy today!

FASCO INDUSTRIES, INCORPORATED
126 Augusta Street • Rochester 2, New York

Fill in coupon below.
Use page margin.

There's a fresh look at FASCO

Please send me full information on the Ventilators and new power Range Hoods

▼NAME and ADDRESS ▼CITY and STATE ECM-458

drop, coefficient of friction, loads, speeds, filming rates, brush hardness and strength. Speer Carbon Div., Speer Carbon Co.

(93) ELECTRICAL CONNECTORS. New 62-page catalog on low-weight, environment-resistant plugs and receptacles, with full descriptions, detailed specifications and complete selection data. Pyle-National Co.

(94) PUSHBUTTON SWITCHES. Data Sheet 143 describes new lighted pushbuttons for control panels, including descriptions and photos, electrical characteristics and prices. Micro Switch.

(95) STORAGE RACKS. New catalog 610 includes step-by-step instructions for assembling racks to suit various storage needs plus description of parts and fittings. Unistrut Products Co.

(96) PHOTOELECTRIC CONTROLS. New 24-page catalog provides illustrations, descriptions, and application diagrams and data on normal, high-speed, ultra sensitive and impulse-actuated photoelectric controls, timing controls and light sources. Autotron, Inc.

(97) INSULATED CABLE. 20-page booklet, "How to Choose Insulated Cable", provides hints for selecting proper cable construction plus a checklist of technical points to be covered in specifying cable circuits. The Okonite Co.

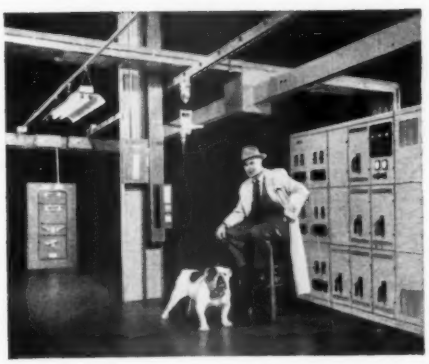
(98) HIGH VOLTAGE POWER CABLES. 4-page technical bulletin RCD-701 describes neoprene-sheathed high voltage power cables for 3 to 15 kv service. Rome Cable Corp.

BOOKS

Symposium on Insulating Oils, 46 pages, $1.75. This symposium is the seventh in a series on the laboratory and field evaluation of electrical insulation. Reports on tests designed to evaluate new oils, oils in service, and reclaimed oils are included. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Engineering Formulas and Tables, 396 pages, $4.75. Handy pocket-size reference manual contains basic formulas, design data and tables on electricity and magnetism, mathematics, mechanics, structural data, reinforced concrete, etc. Data is presented on loose-leaf sheets in an imitation leather binder. Lefax Publishers, Ninth & Sansom Sts., Philadelphia 7, Pa.

New circuits in seconds at half the cost!



COORDINATED COMPONENTS. BullDog equipment works together to feed specific industrial, commercial or institutional power needs. Whether it be LO-X®, Plug-In Duct, a substation or a complete distribution system, BullDog can help you put a business in top electrical shape and keep it there! © BEPCO

As power goes, so goes production. Recently, an automotive parts plant smoothed major kinks in *both* with an installation of BullDog Plug-In BUStribution® Duct. Where powering new machines and constant shifting of existing equipment once meant electrical downtime and delay, machines now plug into power in seconds. No rewiring, downtime or costly production halts. And the electrical cost of moving and adding machinery has been slimmed by 47% .

Plug-In Duct is part of a complete *electrical* distribution system engineered by BullDog for capacity, reliability, *flexibility*. Consider BullDog products for all your jobs. They are easy to install, help you cut down call backs. Consult your BullDog field engineer or distributor. Or write BullDog Electric Products Company, Detroit 32, Michigan.

BULLDOG

BullDog Electric Products Company, Division of I-T-E Circuit Breaker Company, Detroit 32, Mich. *BullDog Export Division:* 13 East 40th St., New York 16, N.Y. *In Canada:* BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

Higher Voltage Distribution Reduces Costs

This is best accomplished in new buildings and modernization projects, by installing SORGEL dry-type transformers at load centers, using higher voltage feeders.

ALL Sorgel dry-type transformers are so quiet that they can be installed in any convenient place, thus assuring the most efficient distribution, best voltage regulation, and lowest wiring cost — in institutional, commercial and industrial buildings.

COST LESS TO INSTALL, because they are all self-contained in a single unit — either single phase or 3-phase — equipped with substantial wall brackets or floor mounting base. No separate brackets to make or buy. Easily accessible, roomy connection compartment, with wide choice of knockouts. Solderless terminals.

LIBERAL DESIGN, HIGH EFFICIENCY. SORGEL dry-type transformers are guaranteed to carry their full rated load continuously at high efficiency. They are so liberally designed that they can carry an overload during an emergency at a safe operating temperature. Vacuum impregnated windings brazed to solderless terminals assure years of trouble-free service.

Available in all standard and intermediate ratings and voltages, ¼ to 3000 Kva, and from 120 volts to 15,000 volts.

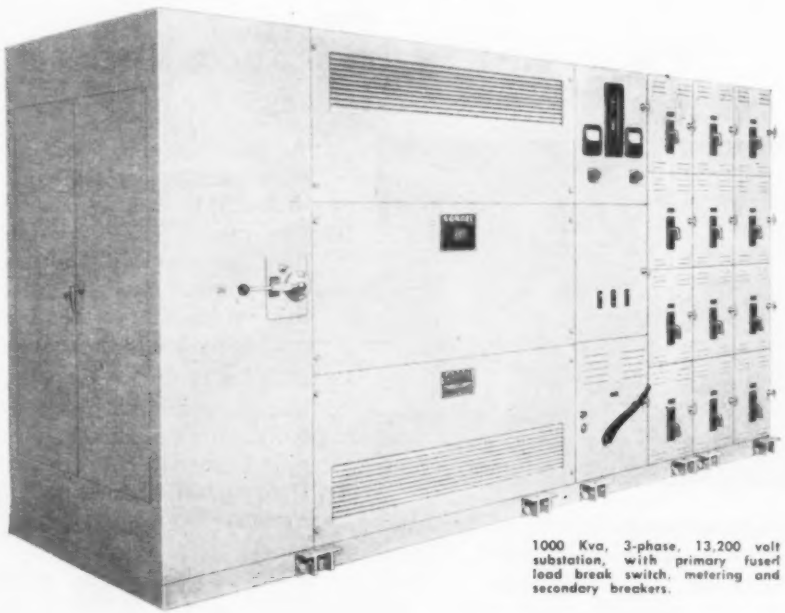
15 to 50 Kva 3-phase, 480 to 208Y/120 volts. Wall mounting transformer. Connection compartment panel removed.

Substation transformers

The same quiet Sorgel transformers, in ALL ratings up to 3000 Kva and up to 15,000 volts, are also incorporated in substations. Procurable with any type or make of switchgear, and from any substation manufacturer.

Sales engineers in principal cities.

Consult the classified section of your telephone directory or communicate with our factory.



1000 Kva, 3-phase, 13,200 volt substation, with primary fused load break switch, metering and secondary breakers.

SORGEL TRANSFORMERS

SORGEL ELECTRIC CO., 836 West National Avenue, Milwaukee 4, Wisconsin

40 years' experience in the development, manufacturing and application of transformers

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Removing Cable From Conduit

QUESTION Q33—We have some 200 ft and 300 ft conduit runs with 4/0 feeders lying therein which we wish to pull out and replace with larger capacity cable.

First attempts to pull out the old 4/0 cables have been unsuccessful since they seem to be frozen or locked in the conduits. Can someone with similar experience suggest a practical method to remove these cables?—R.E.B.

ANSWER TO Q33—Please be advised that we had a similar situation with four 500,000 CM cables in 3½-in. conduit with three 90° elbows which we were unable to pull out with a winch.

We blew into the conduit 3 or 4 lbs of powdered soapstone with an air compressor and allowed it to remain overnight. The next morning three men were able to pull out the cable without the aid of a winch. Apparently the cables were stuck due to the fact the outer insulation had become sticky. The soapstone, being not absorbent, coated the cables forming a smooth surface, which enabled the cables to be removed. This coating of soapstone within the conduit made it much easier to pull in new cable. —W.C.S.

ANSWER TO Q33—One successful method that has been used is steam.

A portable steam generator or jenny is used that will develop approximately 60 to 80 lbs pressure. (In most cities there are companies that rent these units at reasonable rates.)

To rig an adapter to introduce the steam into the conduit in question should present no great problem; however the opposite end of the conduit is left open so that the steam passes through the conduit, and will not build up pressure. Heat and steam will

a. soften hardened wax on conductors.

b. soften outer insulation of the conductor.

c. produce a lubricant in the conduit.

Keep a strain on one of the conductors that are being removed while the steam is being applied.

After the conductors have been removed the conduit should be swabbed. Close supervision is required, and length of time steam is to be applied should be decided in the field.—W.A.D.

ANSWER to Q33—In our work we have ran into stuck cables in conduit and so far we have been able to free them from the conduit by hooking a heavy arc welder on the stuck leads and passing sufficient current through to warm up the cables and the conduit for the total length. With a proper pulling winch the cables should then come out.—D.M.

ANSWER TO Q33—You have experienced what is known as thermoset adhesion. The simplest solution to your problem is to pass sufficient current through the conductors to plasticize the waxy hydrocarbon filler of the conductor insulation. Any suitable high current device will satisfy this requirement. Just short circuit the cable at one end of the run and attach the current source to the other end. The current source should not be disconnected until the temperature of the insulation reaches 140°F, or is warm by feel. A "come along" should be used to break loose the cable.

We used this method recently on an installation replacing 1/0 RW with 3/0 RH cable which resulted in almost 60% added capacity. Of course if sufficient current is not available, do not despair. Cut your conduit run in three or four places and remove the cable in pieces.—J. M.

Two Motors on the Same Load

QUESTION R33—I would like to know if one could run two motors on the same job. For example, two 30 hp 1200 rpm, 3-phase, the same make and speed, one mounted over the other with a matched set of belts the same length for both motors. What horsepower would you have and would both motors share the load?—C.H.

ANSWER TO R33—It is possible to use two motors on the same load. The real question is one of practicality. Of course, one motor of the desired horsepower would be more satisfactory because the over all efficiency will be lower with two motors. If loaded, both motors will supply power to the driven machine. Their respective outputs will be closely matched, but may not be exactly equal. Due to losses in the belts etc., they will not give 60 hp but should approach it closely. I think you would be safe in assuming a 50-hp output for the two combined 30-hp motors.

The motors should be exact mates. Unmatched motors, even though having the same speed, might not share the load. This could result in an overload on one of the motors. Be sure to check the input current to both motors while operating at full load. The two readings should come close to being equal and must not exceed the value given on the motor nameplates. The motors should be installed in such a manner that it is impossible to start them separately and further, if one motor fails, power should automatically be disconnected from both units simultaneously.—F.G.

ANSWER TO R33—An ammeter in each motor circuit plus closely rated fusetrons for each motor is advisable. The ammeter will tell you when a motor starts to fail, while the fusetrons will protect the overloaded motor. The two motors will deliver 60 hp. All double voltage motors are using this system on the lower voltage with good results. —H.S.

Brush Chatter

QUESTION S33—Recently the brushes on one of our large dc machines developed chattering and noisy operation, and to date we have been unable to eliminate this condition. Can someone suggest the possible cause and remedies.—R.E.B.

ANSWER TO S33—The clattering of brushes may not only be annoying, but also be of a sufficient de-

SPECIFY QUALITY . .

insist on McGILL®

The toughest industrial sockets made—

McGill LEVOLIER phenolic and brass sockets have the quality needed to withstand the hard use and abuse of industrial service. Important to you is the saving these sockets offer by eliminating frequent replacement of ordinary sockets.

They are built heavier to last longer with .006" heavier screw shells, double thick molded phenolic casings and the famous LEVOLIER switch mechanism. 660 watt, 250 volt with push button, molded lever or universal pull lever control.

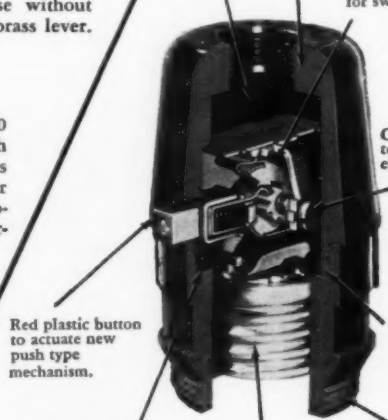
No. 4403-PB single circuit, 660 watt, 250 volt socket with ⅜" cap and shade threads. Double thick impact resisting cap and casing of molded phenolic screws together for easy wiring and assembly. Molded lever and push button adaptation of LEVOLIER switch mechanism. Perfectly insulated with no exposed metal.

No. 4403-FL single circuit, 660 watt, 250 volt socket. LEVOLIER switch mechanism with molded lever control. ⅜" cap, shade threads. This and 4403-PB especially adaptable to machine lighting.

No. 4303-PL single circuit, 660 watt, 250 volt socket. Molded phenolic case with ⅜" cap. Molded phenolic case without shade threads. Plain brass lever.

No. 4100 single circuit, 660 watt, 250 volt brass socket with ⅛" cap and casing that screws together with a locking collar and prevents accidentally snapping the sections apart. Universal pull lever and chain.

No. 4120-PB two circuit, 250 watt, 250 volt for two filament bulbs. Sequence of operation is High, Medium, Low and Off. ⅛" cap. Push button control. Available in molded phenolic also.


Ample space above mechanism permits tieing Underwriters' knot.
Extra heavy shell of impact resisting molded phenolic
Special alloy of high conductivity bronze for switch contacts.
Convenient side terminals avoid uneven wire lengths.
Red plastic button to actuate new push type mechanism.
Upper and lower halves screw together for easy assembly.
Mechanism rigidly supported in shell.
Lamp base screw shell .006" heavier than standard.
Shell completely insulated with no exposed metal.
Approved by Underwriters' Laboratories Incorporated.

FREE! For complete information on McGill sockets, lampguards, switches and other electrical specialties, write for catalog 84.

McGILL®
ELECTRICAL SPECIALTIES

are always a little better and ***ALL*** *are Underwriters Laboratories Inspected*

McGILL MANUFACTURING COMPANY, INC. **450 N. Campbell St., Valparaiso, Indiana**

gree to actually break the carbons. This trouble occurs principally with the type of brush holder which has a box guide for the carbon. The spring that forces the brush into contact rests on top of the carbon, which has a fairly free play in the box guide. The clattering of brushes usually occurs with high-speed commutators (about 4 or 5 thousand ft per minute, peripheral speed).

Lubricating the commutator will immediately check the clattering, but, since there is no commutator compound which gives a lasting lubrication to the commutator, it is not practical. If, however, the angle that the brush makes with the radial line, passing through the center of the carbon and the center of the commutator, is *less than* 10 *degrees and if the carbon trails instead of leading*, the clattering will be eliminated.—J.J.S.

ANSWER to S33—About two years ago we had a similar problem. At that time, after we had "turned down" the commutator surface, undercut the mica between the commutator bars, adjusted brush tension, and checked for mechanical vibration, we found we still had brush chatter. There remained one possible cause: that was loosened commutator bars. But before we could justify the necessary expense of repairing the commutator on our 500-kw generator, we needed proof that our assumption was correct.

Here our physicist came to the rescue. He said, "The space between the commutator segments and the commutator clamp is a sounding box. Take a tuning fork which is tuned to the middle C of the pianoforte (261 cps) and with the reeds vibrating, move the stock (tuning fork handle) from bar to bar. The loose bar can be readily identified." He was right, for in just 15 minutes two loose bars were located. I highly recommend the above if there is the slightest suspicion of loose bars, and that, I believe, is your problem.—J.A.M.

ANSWER TO S33—The causes of brush chatter and poor commutation are many, and because of the numerous possible faults, correction of the condition can be tedious. As a guide in checking the machine, I have listed here the most prevalent causes of poor commutation and brush chatter.

1. The brushes may be incorrectly spaced. Check this by counting the commutator bars between the brushes. This could be due to a brush arm slipping or one or more of the brushes might be oriented at an incorrect angle.
2. Brushes of the wrong grade may have been substituted for the originals. Check the manufacturer's specifications. Also check the brushes for freedom of movement and general condition.
3. Current density in the brush may be too low. This might occur if the machine were operating at a very light load. Current density may be increased by lifting one or more of the brushes in each pole arm. If this results in sparking do not persist, as too high a current density is far more detrimental than one too low.
4. Mica may be high. If so, undercut. Be sure to check all mica segments.
5. One or more commutator bars may be high. It is possible for this to occur at full speed only. Check all bars for tightness.
6. One or more of the commutator bars may be flat or low.
7. The commutator may be grooved. Check 5, 6, and 7, and correct if necessary by turning.
8. The bearings may be worn. This coupled with a slight unbalance can cause the commutator to assume an oscillatory motion which the brushes cannot follow. The pulley might be loose or the belt badly worn. Check all mechanical parts and fastenings, including the foundation, for tightness.
9. Check all armature paths for continuity and correct impedance. Resolder or, if necessary, rewind. —F. G.

Testing an Induction Motor

QUESTION T33—How is a 10-hp, 3-phase, 400-volt induction motor tested with an ammeter to determine if it is underloaded?—G.J.P.

ANSWER TO T33—The simplest test which is also sufficiently accurate would be to use a "clip-on" type of ammeter and compare the readings with the nameplate current. All leads should be tested to determine whether a current unbalance exists and if present to an extent not approved by the motor manufacturer should be corrected. For a 10-hp 3-phase, 440-volt induction motor the usual full load current valve is 14 amps.—C.O.D.

ANSWER TO T33—I would say that the most accurate method for making a load test on this motor would be with a polyphase or two single phase wattmeters.

I have found from past experience that a fairly close check can be made by measuring the current in one leg with an ammeter and using the formula

$$\text{HP} = \frac{\text{Measured Amps}}{\text{Nameplate Amps}} \times \text{Nameplate HP}$$

D.S.V.

ANSWER to T33—Look at the nameplate on the motor; it will give you the "Full Load Amps"—12.6 amps. (12.6 amps as given is the average value for a 10 hp, 3-phase, 1800 rpm, 440-volt motor and will vary somewhat, depending largely upon the make and type of motor). Then take a grab-amp ammeter and put around one motor leg. If it reads below the rated full load amps, it is underloaded. Leave the ammeter around the motor leg and start loading the motor up until the ammeter reads 12.6 amps. Then check the other two motor legs to see if the current is in balance on all motor legs. If any one leg reads over 12.6 amps, back the load down so that the highest reading on any motor leg is 12.6 amps. Motor is now at full load.—C.D.

ANSWER TO T-33—Don't use an ammeter; use a wattmeter. This will tell you directly, without guess work, if the motor is fully loaded. Divide the wattmeter reading by 746 to convert it to horsepower, and allow about 5% for motor losses. 10 hp would be 7460 watts, and allowing for motor efficiency you could expect about 7900 watts at the motor terminals.

An ammeter is not satisfactory for checking alternating current motor loads because as load decreases, power factor drops. Current is then no longer directly proportional to power, and the ammeter readings are unreliable as an indication of load. For the same reason, power cannot be obtained by the simple use of an ammeter and voltmeter as in a direct current circuit.—D.H.N.

Insulation-Resistance Measurements

QUESTION U33—In insulation resistance measurements, what is meant by "the dielectric absorption of the insulation"? With motor-operated megometers, what is indicated if the reading continues to increase (higher megohms) for about 15 minutes before a steady state value is reached?—J.M.

ANSWER TO U33—The "dielectric

RIBBONS OF LIGHT—Sylvania recessed troffer lighting can be mounted in continuous rows and spaced for desired high lighting levels in modern business offices.

Introducing . . .

a new Shallow Troffer Series by Sylvania— recessed lighting for today's building methods

For the cost-conscious electrical contractor, who is coping with the modern trend to lower ceilings and shallower plenum spaces . . . here is a new approach to recessed lighting. It's Sylvania's new Shallow Troffer Series, fixtures which measure no more than 5½" from top to bottom—and, in many cases, require no additional depth for recessed mounting.

These new Troffers are available in a wide variety of models, in one- and 2-foot widths, and with a choice of time-saving mounting methods to fit almost any new type of ceiling construction. Exclusive snap-up hanger device (see sketches below) makes for easy mounting in acoustical ceilings where supporting elements are parallel to the troffer. Other high-speed mounting methods include lay-in troffer for Z-spline and inverted-T ceilings, and end-support brackets for acoustical ceilings with furring channels or metal panels perpendicular to the troffer.

With Sylvania Shallow Troffers, attractive recessed lighting is practical again in all new buildings. Unsightly latches and hinges are concealed. Units are engineered for continuous-row or individual mounting. Several types of housing flange and shielding media are available (see below). We suggest you talk over the many time- and cost-saving advantages of new Sylvania Shallow Troffers with your Sylvania Fixture Specialist or Select Distributor. Write for *Free* new folder of technical details.

SYLVANIA ELECTRIC PRODUCTS INC.
Dept. D-40, Lighting Division—Fixtures. One 48th Street, Wheeling, W. Va.

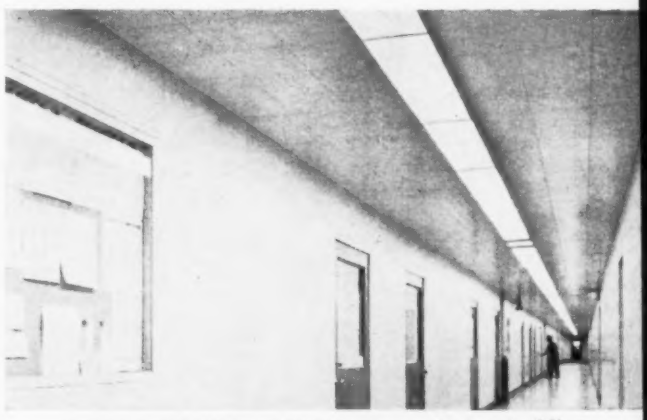
SYLVANIA

Fluorescent Lighting Fixtures and Systems

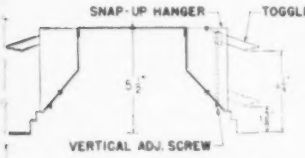
Best fixture value in every price range

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

INDIVIDUALLY MOUNTED troffers, imaginatively arranged, combine attractive design with good basic light distribution for company cafeterias and lounges.

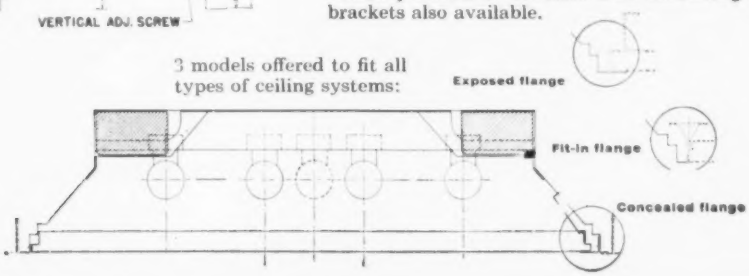


STRIKING, PLEASANT ACCENT for an up-to-date building corridor: Sylvania recessed lighting troffers continuous-row mounted with acoustical ceiling materials.

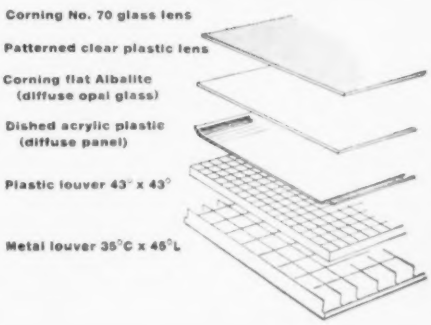


NEW 5½" HIGH TROFFER utilizes full plenum space. Exclusive *snap-up hanger*, with vertical adjusting screw, provides secure side-mounting for acoustical ceilings with support elements parallel to troffer. End-mounting brackets also available.

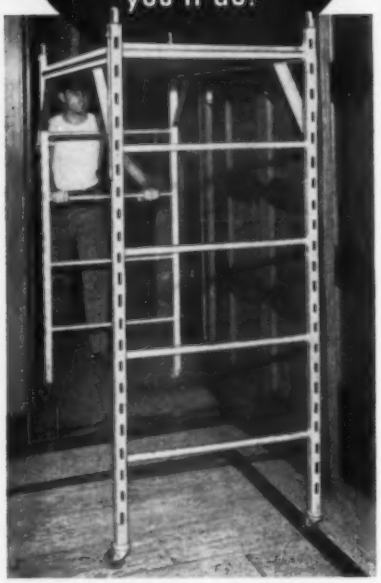
3 models offered to fit all types of ceiling systems:



ALL STANDARD TROFFER SHIELDINGS


Corning No. 70 glass lens
Patterned clear plastic lens
Corning flat Albalite (diffuse opal glass)
Dished acrylic plastic (diffuse panel)
Plastic louver 43° x 43°
Metal louver 35°C x 45°L

THE
RIGHT SIZE
SCAFFOLD
for most of the jobs you'll do!



It's not overly large—or small—it's just right for easy portability and convenience. Add another unit and you can go higher or wider. The Baker Scaffold is designed for those normal off-the-floor requirements where scaffold mobility can save manpower, time and money.

Easy to set up, **easy** to take down, **easy** to move—yet **strong, sturdy** and **durable.** Has the substantial feel of steel that only steel can give — because it's made of steel.

LISTED UNDER RE-EXAMINATION SERVICE UNDERWRITERS' LABORATORIES, INC.

BAKER
SCAFFOLDS
DESIGNED FOR PORTABILITY • BUILT FOR DURABILITY

Write for
Baker Scaffold
Bulletin #583

BAKER-ROOS, INC.
P. O. Box 892, Indianapolis 6, Indiana

Gentlemen: Send the folder described on Baker Scaffolds without obligation. ECM

Name_____
Organization_____
Address_____
City_____ State_____

DISTRIBUTORS IN PRINCIPAL CITIES

absorption" of the insulation is the "soaking up" of the direct current charge into the dielectric.

There are three causes for the continued rise in insulation resistance after the first in-rush of current in the apparatus.

First: Dielectric absorption or the "soaking up" of the direct current charge in the dielectric. Observing the pointer of the Megger instrument as it "eases up" to its reading, you can almost see the absorbing effect. The final constant resistance arrived at is the true insulation resistance at that voltage. The time required may be a matter of minutes or even hours in some equipment.

Second: Electrostatic capacitance is the direct current "charge" that must be built up in the capacitance equal to the testing voltage and maintained while the reading is made. It may take up to 15 minutes or more for this "charging" process and for the pointer of the Megger tester to creep up the scale to its final and apparently maximum reading. Thus the pointer will "ease up" to its reading slowly or rapidly, depending on how much "charging" is required for the apparatus under test, and also on the actual value of insulation resistance encountered. In general, if the insulation resistance runs to a few hundred megohms and higher, a longer "electrification" time is required to reach an equilibrium than when the final values are less than 50 to 100 megohms. If this electrification effect is observed, the chances are that the insulation is in better condition than if the readings come up abruptly to whatever value the insulation resistance may be.

Third: Surface leakage. By turning the Megger crank slowly at first, then rapidly increasing the speed, it is possible to detect surface leakage. The pointer will make slight kicks down the scale. The surface leakage may be due to moisture, dirt or breakdown of the insulation.

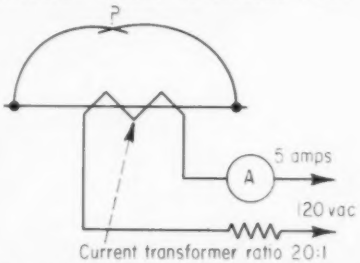
In conclusion, it is important that you watch very carefully the behavior of the pointer on the Megger when making insulation resistance tests.—C.D.

ANSWER TO U33—The ASA says dielectric absorption is that property of an imperfect dielectric whereby there is an accumulation of electric charges within the body of the material when it is placed in an electric field. This is manifested on charging a dielectric by a decrease in current with time to a steady-state conduction current. In normal insulation testing the insulation acts as the imperfect dielectric of a condenser; the conductor acts as one plate and ground steel; another conductor, etc. acts as the other plate. An increasing Megger reading indicates the insulation is in very good condition.

The Biddle Co. suggests using a ratio of a ten minute reading to a one minute reading. If this 10:1 minute ratio is between three and four the insulation is considered good. Any readings over four are considered excellent of course.—H.R.W.

Can You Answer These QUESTIONS

QUESTION E34—If I send 5 amps through the secondary of a current transformer, will 100 amps flow through the primary circuit if it is shorted? (Ratio of current transformer 20 to 1.) Suppose a load of 10 ohms is connected to the primary. What happens to the current and voltage?—H.G.R.



QUESTION F34 — A 5-hp motor drove a fan at 600 rpm. We decided to increase air circulation by driving the fan at 700 rpm. Motor temperature indicated that it was delivering only about 4 hp, but when we stepped up to 700 rpm, the motor heated as if it were very much overloaded. Why?—G.J.P.

QUESTION G34—Will you kindly explain with the use of vectors the reason for the phase shift between two feeders supplied by delta-wye transformers connected to the same source on the high side.

This shift occurs when the phase rotation is changed on both the high and low side of one of the 3-phase transformers.—A.T.K.

QUESTION H34—What type of powder is used to seal explosion proof fittings?—H.S.

PLEASE SEND IN YOUR ANSWER BY MAY 15

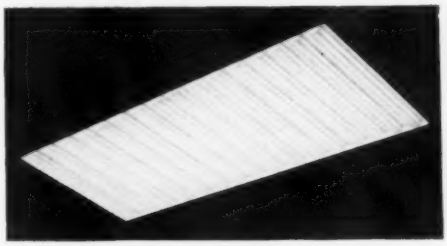
(*Advertisement*)

THESE AUTHORIZED DISTRIBUTORS CAN
HELP YOU SOLVE YOUR LIGHTING PROBLEMS

ALABAMA
Birmingham:
Mayer Elec. Sup. Co.
CALIFORNIA
San Francisco:
California Elec. Sup. Co.
COLORADO
Denver: Central Elec. Sup.
CONNECTICUT
Bridgeport: B. M. Tower
Hartford:
Beacon Light & Sup. Co.
New Haven:
Grand Light & Sup. Co.
New London:
United Elec. Sup. Co.
Stamford: Marle Co.
DISTRICT OF COLUMBIA
Maurice Elec. Sup. Co.
National Elec. Wholesalers
O. R. Evans & Bros.
FLORIDA
Miami:
Farrey's Whsle. Hdwe. Co.
GEORGIA
Atlanta: Atlanta Ltg. Fix.
ILLINOIS
Chicago:
Efengee Elec. Sup. Co.
Englewood Elec. Sup. Co.
Hawkins Electric
Hyland Elec. Sup. Co.
Wholesale Elec. Sup.
Elgin: Fox Elec. Sup.
Rockford:
Englewood Elec. Sup. Co.
Springfield:
Springfield Elec. Sup.
INDIANA
Ft. Wayne:
Mossman-Yarnelle Co.
Gary:
Englewood Elec. Sup. Co.
So. Bend:
Englewood Elec. Sup. Co.
IOWA
Des Moines:
Weston Lighting Co.
KANSAS
Kansas City:
W. T. Foley Elec. Co.
KENTUCKY
Paducah: Ohio Valley Sup.
LOUISIANA
Baton Rouge:
Electrical Wholesalers
New Orleans:
Interstate Elec. Co.
MAINE
Bangor: Standard Elec. Co.
MARYLAND
Baltimore:
Atlantic Illuminating Co.
MASSACHUSETTS
Boston:
Mass. Gas & Elec. Light Co.
Henry L. Wolfers Inc.
Fitchburg:
Service Elec. Sup. Co.
Pittsfield: Carr Supply
Springfield:
Eastern Elec. Sup.
Worcester:
Atlantic Elec. Sup.
Benjamin Elec. Sup.
MICHIGAN
Detroit:
Madison Elec. Co.
Michigan Chandelier Co.
Flint: Royalite Co.
Grand Rapids:
Purchase Elec. Sup. Co.
Pontiac:
Standard Elec. Co.
Saginaw: Standard Elec.
MINNESOTA
Duluth:
Northern Elec. Sup. Co.
Minneapolis:
Charles A. Anderson & Co.
Northland Elec. Sup. Co.
St. Paul: Lax Elec. Co.
MISSOURI
St. Louis: M. K. Clark
NEBRASKA
Omaha:
Electric Fix. & Sup. Co.
NEVADA
Reno:
Western Elec. Dists. Co.
NEW HAMPSHIRE
Portsmouth:
Mass. Gas & Elec. Light Co.
NEW JERSEY
Atlantic City:
Franklin Elec. Sup. Co.
Camden:
Camden Elec. Fix. Co.
NEW YORK
Albany:
Havens Elec. Co. Inc
Binghamton:
Freije Elec. Sup. Co.
Buffalo:
Buffalo Incan. Light Co. Inc.
Niagara Falls:
Hysen Sup. Co.
Poughkeepsie:
Electra Sup. Co.
Rochester:
Rowe Electric Sup. Co.
Syracuse: Superior Elec.
NORTH CAROLINA
Charlotte:
Independent Elec. Sup.
Durham: Noland Co.
Greensboro:
Elec. Sup. & Equip. Co.
Kinston: Kinston Elec.
Winston-Salem:
Noland Co.
OHIO
Akron:
The Sacks Elec. Sup. Co.
Canton: The Electric Sales
Cincinnati: B. & B. Elec.
Cleveland: H. Leff Electric
Columbus:
Elgee Elec. Co.
The Loeb Elec. Co.
Dayton: Martin Elec. Co.
Duellman Elec. Co.
Toledo: Gross Elec.
Youngstown:
Mart Industries
OKLAHOMA
Tulsa: Lawson Elec. Co.
PENNSYLVANIA
Allentown:
Coleman Elec. Co.
Erie: Kraus Elec. Co.
Harrisburg:
Fluorescent Sup. Co.
Hazleton:
Power Elec. Co. Inc.
New Castle:
Midwestern Elec. Co.
Philadelphia:
Ace Lighting Fix. Co.
Gold Seal Elec. Sup. Co.
Sylvan Elec. Fix. Co.
Pittsburgh:
Allied Elec. Sup. Co.
Argo-Lite Studios
Doubleday-Hill Elec. Co.
Wally Elec. Sup. Co.
Reading: Coleman Elec. Co.
Scranton: Lewis & Reif
Wilkes-Barre:
Anthracite Elec. Sup. Co.
RHODE ISLAND
Pawtucket:
Major Elec. Sup. Co.
Providence:
Leavitt Colson Co.
SOUTH CAROLINA
Anderson:
Sullivan Hdwe. Co.
Columbia:
Capitol Elec. Sup. Co.
Noland Co.
Greenville:
Sullivan Hdwe. Co.
SOUTH DAKOTA
Watertown:
J. H. Larson Elec. Co.
TENNESSEE
Johnson City: Noland Co.
Nashville:
Nashville Elec. Sup. Co.
TEXAS
Dallas: Rogers Elec. Sup.
Ft. Worth:
Anderson Fixture Co.
Houston:
Martin Associates
San Antonio:
Southern Equip. Co.
VIRGINIA
Arlington-Rosslyn:
Noland Co.
Lynchburg:
Mid State Elec. Sup. Inc.
Norfolk: Noland Co.
Roanoke: Noland Co.
WEST VIRGINIA
Charleston:
Goldfarb Elec. Sup. Co.
Virginian Electric Inc.
Huntington:
West Virginia Elec. Co.
Wheeling: The Front Co.
WISCONSIN
Appleton:
Moe Bros. Northern Co.
Eau Claire:
W. H. Hobbs Sup. Co.
La Crosse:
W. A. Roosevelt Co.
Milwaukee:
Lappin Elec. Co.
Standard Elec. Sup.
WASHINGTON
Seattle:
Seattle Lighting Fix. Co.
ALASKA—*Anchorage:*
Northern Supply Co.
CANADA
Montreal:
The Gray Elec. Co.
Toronto:
Revere Elec. Dist.
Toronto Elec. Sup. Co.
HAWAII
Honolulu:
Hawaiian Light. & Sup. Co.

WHO'S ON THE LADDER WITH SMITTY?

The man who's almost there is the Lightolier engineer who planned the time-saving installation features of every Lightolier. Take our new fluorescent Strialux fixture. It has detachable grab handles, flexible sides, started screws, snap-toggle yokes . . . a host of cost-cutting features. And, it fits quickly and easily into all the new 2′ x4′ modular ceilings and into plaster construction. You'll get more satisfied customers, too, because of its glare-free light, easy maintenance. For the whole story, check the authorized Lightolier distributors listed left. By the way, their men are ready to go out on calls with you, help you get more profitable orders. See them now or write us at Dept. EC-48

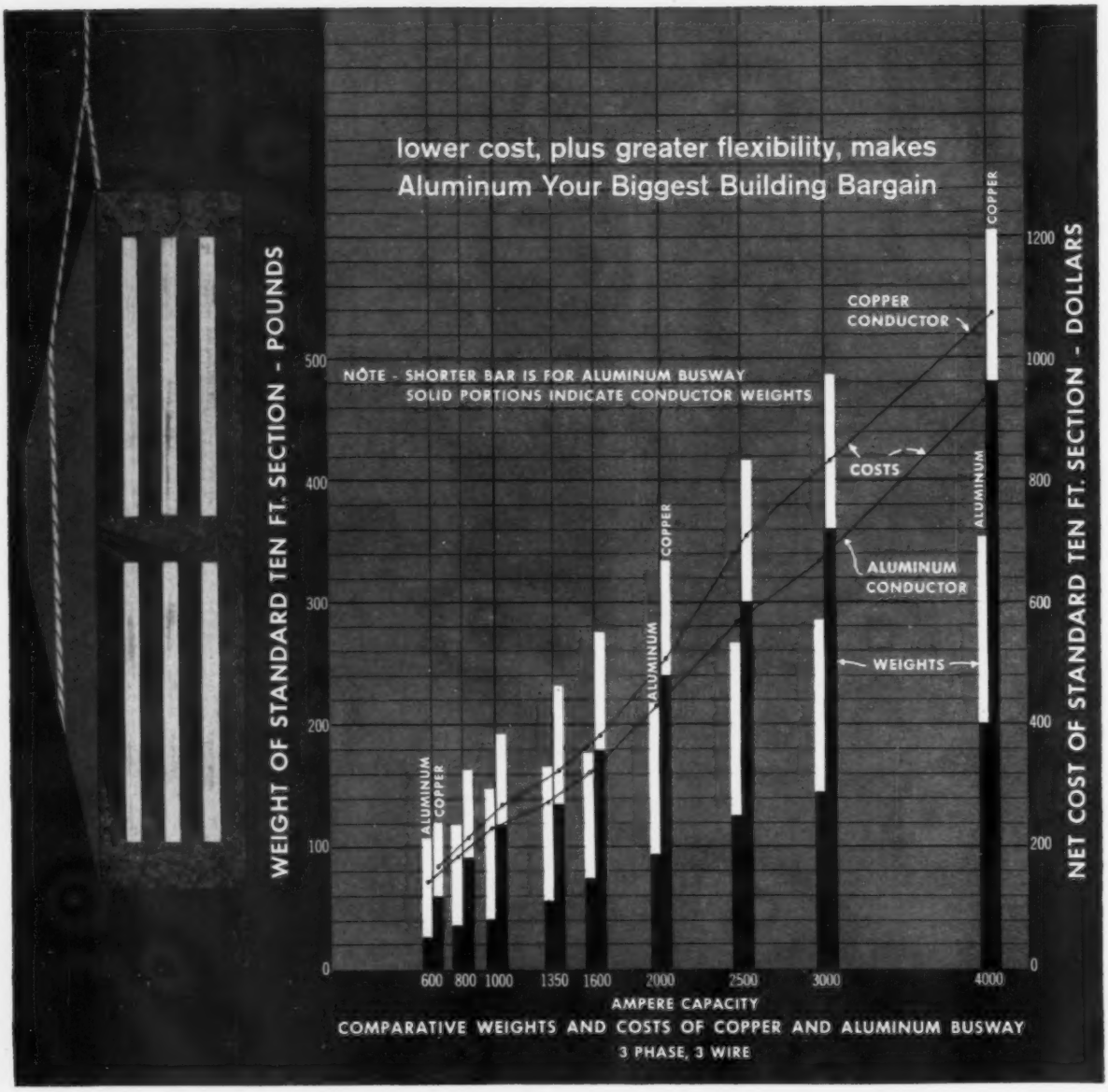


THE ARCHITECTURAL LIGHTING DIVISION

LIGHTOLIER

ARCHITECTURAL LIGHTING • RESIDENTIAL FIXTURES • PORTABLE LAMPS

MAIN OFFICE AND FACTORY: Jersey City 5, New Jersey SHOWROOMS: New York, Chicago, Los Angeles



Aluminum Busway helps reverse trend to higher building costs

Comparison of initial cost of aluminum busway compared to copper shows aluminum has a price advantage, even in the smallest sizes.

Probably no other product used by the building industry can offer savings comparable to aluminum busway: up to 20% on material costs, up to 20% on installation costs and savings in weight permitting the use of less costly busway supports. Aluminum busway requires less space than cable and conduit.

Modern aluminum busway, with lightweight Alcoa® Aluminum Bus Bar, also offers flexibility to meet new and increased power demands. Future loads can be tapped off at any point. Pound for pound, aluminum busway has greater current-carrying capacity at less cost than conventional wiring systems.

When *you* need a modern, flexible distribution system, specify busways made of Alcoa Aluminum . . . and *save*. Aluminum Company of America, 2302-D Alcoa Building, Pittsburgh 19, Pennsylvania.

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

"ALCOA THEATRE"
Exciting Adventure
Alternate Monday Evenings

Questions on the Code

Answered by:

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

Underground Distribution System

Q. *We are designing a high voltage 4160/120-208-volt underground distribution system (primary metering) to a series of underground transformer vaults, each serving six or more buildings of various load requirement.*

Does code rule pertaining to (600-volt or less) secondary transformer conductors, classed as service conductors, limit the number of taps that can be made at the secondary transformer bus without regard to conductor size or overload protection? Using 250- to 350-kva transformer units, what consideration should be given interrupting capacity of the service switch at the buildings?—E.F.S.

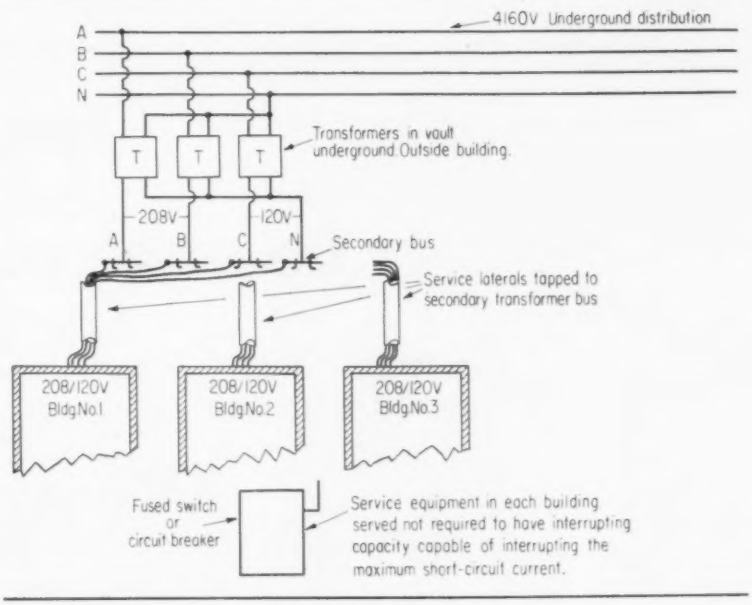
A. According to the fine print note preceding Sections 2386 through 2392 of the Code, which concerns services exceeding 600 volts, it appears to me that none of the provisions of Article 230 apply when the transformers are located outdoors and the secondary, which serves the building, operates at 600 volts or less. In the case presented the transformers are located outside the building served and the service to each building is a 3-phase, 4-wire wye, operating at 208/120 volts. It should be noted however, when the transformers are installed in a transformer vault in the building served, all of the provisions of Section 2386 through 2392 must be satisfied unless the vault is under the sole control of the electrical utility. I mention this provision since it makes a distinction between a transformer vault under private control and one under the control of the utility. In the first case all of the primary wiring must satisfy the provisions covering services exceeding 600 volts, and in the second case there are no provisions which restrict the procedure that the public utility sees fit to apply. It is also important to note however when the transformers are located outdoors, that there is no distinction with respect to ownership and none of the rules of Article 230 apply. The provisions of Article 710 however appear to apply to your underground distribution system, but the questions raised are not covered by this Article.

In view of the foregoing code provisions, it is my personal opinion that there are no specific provisions which would prohibit the connection of more than one set of service taps to the secondary bus of the transformer. I also believe there are no code provisions covering the size of the protection of such service laterals, as defined under Article 100 covering definition. I believe the example is similar to any ordinary service installation connected to a utility distribution system. We all know that our service drops and laterals are not subject to the current-carrying provisions of Section 2304 which only apply to service entrance conductors; and we all know that the service conductors to a building are considered as unprotected conductors and may destroy themselves when a fault occurs.

This condition however may be minimized when the taps are of sufficient current-carrying capacity to promote the operation of the primary overcurrent device.

Insofar as the code is concerned, there are no provisions with respect to the interrupting capacity of a service switch operating at 600 volts or less. Section 2357 merely states that the service switch shall have a rating not less than the load to be carried, determined in accordance with Section 2203. On services exceeding 600 volts, there is a specific requirement, covered by Section 2389-d, which definitely requires a circuit-breaker to be capable of interrupting the maximum short-circuit current to which it may be subjected. Service fuses are likewise subject to a similar provision as covered by Section 2389-c.

During the past couple of years a proposal to recognize high amperage interrupting capacity fuses, 600 volts or less, was presented to Panel No. 4 of the Electrical Committee but it was rejected. A 300-kva transformer operating at a 120/300-volt secondary could have a short circuit current as high as 22,900 amps. Several factors however could influence this short circuit current, such as the nature of the fault and the impedance of the line to the source of supply. The nature of the load also is involved. According to the above a 22,900-amp short circuit current would require the use of a 25,000-amp interrupting capacity breaker rated at



you're not

still using

safety

switches?

but if you are,

be sure to read these

facts from

Westinghouse...

Safety switches versus AB-I breakers is an old, old controversy. Westinghouse manufactures both at their Beaver, Pennsylvania plant.

Here's their authoritative, unbiased report in the interest of better circuit protection:

Fact: AB-I's cost less. In most all motor applications, AB-I's are lower priced than an equivalent safety switch equipped with fuse. (For a rating-by-rating cost comparison, write to the Westinghouse address shown below.)

Fact: AB-I's require less mounting space. To protect a given motor size, the AB-I breaker will nearly always be smaller (up to 40% smaller, never larger) than an equivalent safety switch.

Fact: AB-I's require no maintenance. No costly fuses to replace; no production time-loss due to fuse replacements; no maintenance of any kind!

Fact: AB-I's are safer. With breaker protection, motors can't single-phase. There are no exposed live parts on an AB-I breaker to endanger workmen; no need to open the cover to reset the handle; no dangerous fuse replacements.

Fact: AB-I's are more versatile. Only with AB-I breakers can you use convenient, time- and money-saving accessories such as bell alarms, shunt-trips, auxiliary interlocks, etc.

It's a fact. AB-I breakers are the safest, surest, least costly means of circuit protection. On your next order, order the best in AB-I breakers—by Westinghouse.

J-30292

YOU CAN BE SURE...IF IT'S

Westinghouse

Westinghouse Electric Corporation
STANDARD CONTROL DIVISION
Beaver, Pennsylvania

600 amps. If the breaker was rated higher than 600 amps, it should be rated at 50,000 amps interrupting capacity. Fuses are normally rated by UL at 10,000 amps although there are some current interrupting devices having standard dimensions of code fuses which have higher current interrupting capacity; and there are some devices such as the "high cap" or "amp trap", not as yet recognized by UL which have unlimited interrupting capacity according to the manufacturer.

Regardless of the code, which does not provide for interrupting capacity on switches or breakers rated at less than 600 volts, many of our design engineers, influenced by the ever increasing capacity of our distribution systems, consider this factor and require such devices to have adequate interrupting capacity. The interested utility should be consulted and also the National Electrical Manufacturers Association, who are in a position to give dependable advice on this question. Fig. 1 portrays the example you have presented as I understand it.—B.A.McD.

Sealing Conduits—Service Station

Q. *Would you please give me your opinion on the following installation made in a so-called "gas service station". The building consists of two sections; one side is the office or sales room, the other side is for greasing cars, etc. In front are several islands with pumps and the usual outside equipment.*

The situation concerns the wiring of several receptacles around the walls of the work section. The lighting panel is located in the office section, and well above the 18-in. height. From this panel a run of conduit runs down vertically and goes under the concrete floor to the work section. Here it is built into the cinder block walls and rises (in the walls) to 4½ ft, where an outlet is located. From this outlet box, another conduit goes back down inside of the wall and comes up again at another point. This is repeated for several outlets.

The question is, where and how many seals are required? My contention is that as long as the floor of the office and work section are on the same level, without any 18-in. curb and only an ordinary door separating these two sections, the entire area along with area under floor becomes hazardous up to a height of 18 in., and any conduit entering from a height above 18 in., or any conduit leaving this area should be sealed within 18 in. of leaving or entering. This would make location of seals a maximum of 36 in. from the floor, on both ends of the run.

I further contend that the fact that the conduit run starts above 18 in. and/or terminates above 18 in., or the fact that the run is under the floor or in the walls, has no bearing on the matter whatever. Operating rooms in hospitals also have the conduit runs concealed in walls, etc. (for appearances). I feel that conduit runs should be run exposed on walls or some other idea employed that will allow runs to be sealed off on both ends, and within required height.—C.L.

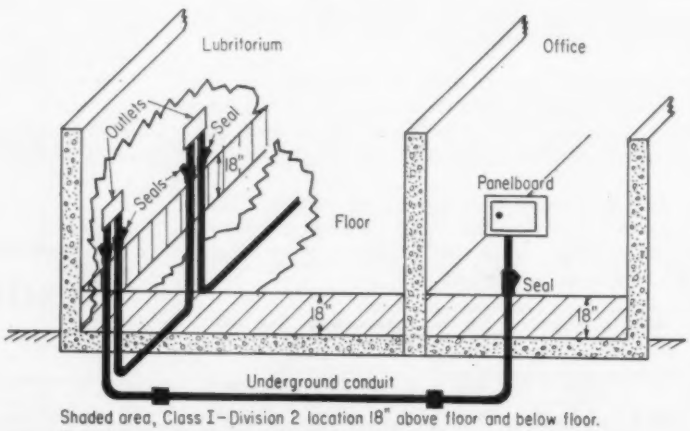
A. According to Section 5120, which concerns gasoline dispensing and service stations, areas such as lubritoriums, repair rooms, offices, etc., are subject to the provisions of Section 5105 which covers commercial garages. Reference to this rule indicates that the section of the building under discussion, which is used for oil changes, greasing or other similar services, comes within the scope of a garage occupancy. As a result a Class 1, Div. 2 hazardous location exists to a level of 18 in. above the floor, and approved seals are required as covered by Section 5105-d., which in turn refers us to Section 5015 of Article 500, the fundamental provisions for seals in any type of hazardous location.

According to the provisions of Section 5105-b-4, the office section of the building also is considered to be a Class 1, Div. 2 location since it is not properly cut-off from the lubritorium as required. This hazardous area also extends to a distance of 18 in. above the floor.

For the benefit of our readers, we have endeavored to illustrate by Fig. 1, the wiring procedure you have described, and we have also indicated our concept of the sealing fittings required. According to Section 5015-b-2, a seal is required on each conduit run passing from a Class 1, Div. 2 location into a nonhazardous location. As a result a seal must be installed, as shown on Fig. No. 1, when the conduit leaving the panelboard in the office section enters the hazardous area 18 in. above the floor. Seals also must be installed where the conduits, which are buried in the masonry wall, enter or leave the hazardous area 18 in. above the floor. It should be noted that Section 5105-d advises that the raceway embedded in the masonry floor or buried beneath a floor shall be considered to be within a Class 1, Div. 2 location, if any connections or extensions lead into or through the hazardous area above the floor.

A question which frequently arises concerns the status of the conduits embedded in the masonry wall. Are they also in the hazardous area to a distance of 18 in. above the floor? Is it necessary to install a seal on the concealed conduit, buried in masonry, at the 18-in. level? While the code does not specifically cover the status of conduits embedded in masonry walls of a garage occupancy, we may assume that they either are, or are not in the hazardous area. If they are not considered to be in a hazardous area we must install a seal where they emerge from the underground hazardous area at the floor level. If

Fig No.1



Shaded area, Class I–Division 2 location 18" above floor and below floor.
Outlet boxes and conduits embedded in masonry wall.
Seals required as shown on concealed conduits.

Here's Why...

Silicone Insulated Motors Help Keep Production Moving

When the heat's on production and machines are pushed to rated capacity and beyond, motors get hot too. That's when it pays to have drive motors and essential auxiliary motors insulated with heat stable Dow Corning silicone insulation.

Silicone insulation withstands temporary overloads that burn out other insulation. Insulated with silicones, motors keep going even when pushed 50% above rated capacity, practically eliminating the most frequent cause of work stoppages.

If your plant is automated or has continuous processing lines you can rely on motors insulated with Dow Corning Silicones to keep production moving ahead.

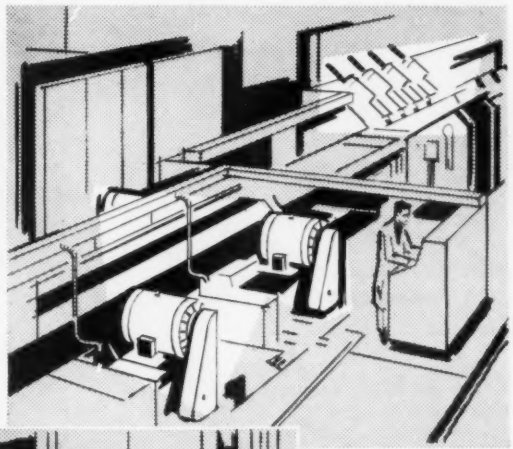
What's more, you can count on reliable motor performance despite high ambients, moisture, plugging, rapid reversing or corrosive atmospheres.

Leading motor builders now offer motors insulated with Dow Corning Silicones. Both ac and dc motors, silicone-insulated for longer insulation life, are available in standard frame sizes.

For maximum reliability and to keep production moving despite the heat of temporary overloads—

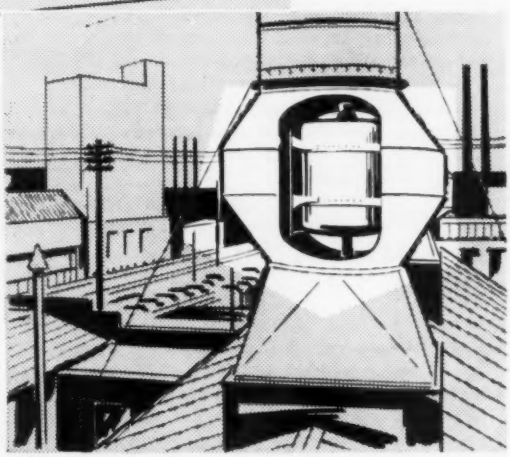
Specify DOW CORNING SILICONES and *Save*

Write Dept. 394 for list of builders who offer Dow Corning silicone-insulated motors.



On production set-ups, where downtime is measured in lost profits, silicone-insulated motors keep going despite overloads.

In continuous processing, fluid handling equipment stays "on stream" despite moisture, overloads and high ambient temperatures.



Silicones add reliability to essential auxiliary drive motors. This cupola exhaust fan motor is cooled by oven-hot air.

first in silicones

Dow Corning CORPORATION

MIDLAND, MICHIGAN

ATLANTA • BOSTON • CHICAGO • CLEVELAND • DALLAS
DETROIT • LOS ANGELES • NEW YORK • WASHINGTON, D. C.

they are considered to be in a hazardous area to a height of 18 in. above the floor, we must install a seal at this point as shown on the illustration. Regardless of the assumption, seals are involved in either case, and I am inclined to believe that the proper location would be at the 18-in. level as shown. The status of conduits buried in a masonry wall of a hospital operating room is more clearly defined, as reference to Section 5135-c will verify.

Since a seal fitting should not be embedded in a masonry wall, we have shown by Fig. 2 how it may be

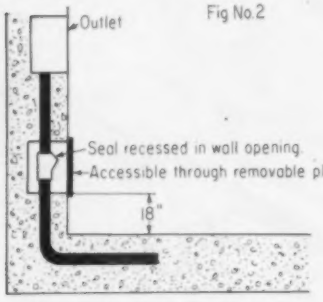


Fig No. 2

installed in a recessed wall opening covered by a removable plate. This procedure offers access to the seal whenever desired.

Why all this fuss about seals in a conduit embedded in a masonry wall? I believe the illustration answers this question. Underground conduits in a garage occupancy are exposed to gasoline, oils, alcohols and other hazardous liquids, which seep through the floors and find their way to the conduit. The resulting vapors fill the conduit and find their way to the arc producing device, such as a switch or receptacle, at the outlet. An explosion results. When seals are installed as required, the vapor movement is confined to an area isolated from any source of ignition. The fact that the conduit is concealed or exposed does not alter the hazard in any respect.

I believe that the example presented indicates the important fact, that once you get out of a hazardous area you should endeavor to keep out of same.

Automatic Sprinkler System

Q. *A building in this city is being equipped with an automatic sprinkler system and in order to supply adequate power for the operation of the fire pumps being installed in connection with this fire protection system, it will be necessary that we run a second service to this building. Must the service equipment for this special fire service be located adjacent to the main building service equipment?—A.P.B.*

A. No, it is not necessary that the second set of service equipment being installed exclusively for the operation of the fire pump be located adjacent to the building service equipment as you will note under Section 2360 of the Code that services as are permitted in Sections 2301-b, 2301-c and 2321 are exempt from the requirement contained in this section. Section 2321 provides for special service for fire pumps.—G.R.

Motor Disconnecting Means

Q. *Under Motors and Motor Controllers, Section* 4406 *states: "The disconnecting means shall disconnect both the motor and the controller from all ungrounded supply conductors."*

If a separate control supply is used, may a starter be wired as shown in Diagram No. 1, *or is an auxiliary contact required on the disconnect switch as shown in Diagram No.* 2?—J.H.C.

A. This code question is answered by Section 4374 which requires a switch to be installed in the 125-volt control circuit, and recommends that it be installed adjacent to the motor disconnecting means. This switch shall be so arranged that the control circuit including its various components are disconnected when in the open position. As shown on your Diagram No. 1, this control circuit switch would be located ahead of the pushbutton shown. The auxiliary contact in diagram is not required by the code. When it is used in lieu of the separate disconnecting means it also must be located in the circuit so that the controller and its components are disconnected when the contact is in the open position.

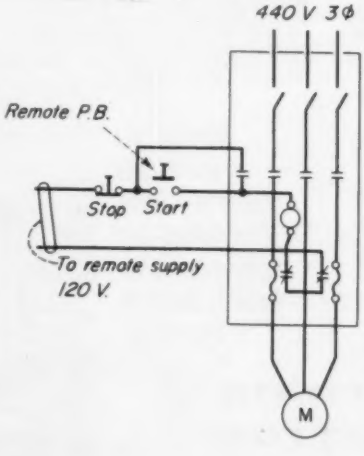
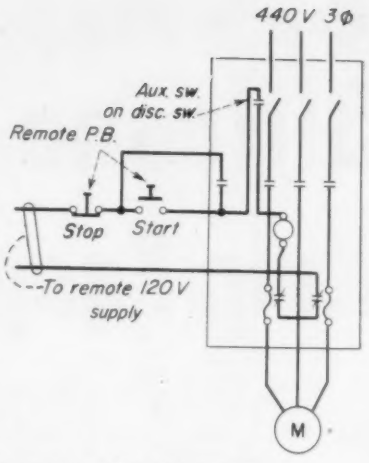


Diagram No. 1



Is an aux. switch necessary?

Diagram No. 2

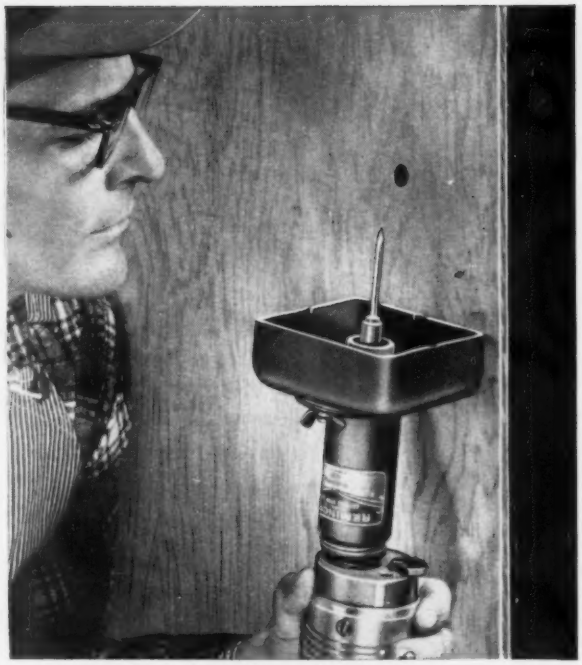
The principal objective of the code is to see that no live terminals or conductors exist in the motor or its controller when the motor disconnect and the control circuit disconnect are in the open position.—B.A.McD.

Wiring for a Farm House

Q. *We are wiring a farm dwelling with nonmetallic sheathed cable and want to ground the metallic fixtures in the bathroom to the copper water pipe serving the bathroom, but inasmuch as the house is connected to a well at some distance by means of plastic underground water pipe, we had to ground the neutral with a driven rod electrode which is located at just the opposite side of the building from which the water service enters. Can we drive another electrode adjacent to the water service to ground the copper piping which goes up to the bathroom?—O.F.*

A. No. The National Electrical Code under Section 2554 will require that the same ground electrode be used to ground both the

If operator inadvertently fires new Remington Captive Stud Tool into inadequate base material—



Captive Stud Guard Assembly prevents free flight of stud which is locked to tool during firing.

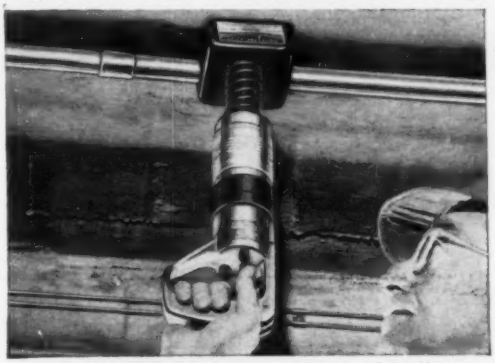
Safest Stud Driver Ever Designed!

Remington Stud Driver...with Model 440 Captive Stud Guard Assembly

Power, efficiency, speed *and safety* are features of the new Remington Stud Driver with Captive Stud Guard Assembly. It's designed to prevent free flight of studs through a working surface . . . permitting use of the tool in a whole new range of fastening situations.

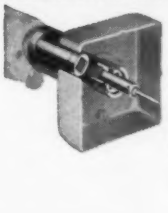
Just squeeze the trigger to anchor wood or metal sections to concrete or steel with ¼" diameter Remington Studs. Scientifically graded 22 caliber Power Loads furnish *exact* driving force you need to do the work. No pre-drilling, no outside connections required!

What's more, you can choose from a *complete* selection of ¼" diameter Remington "Power-Guide" Studs. And for particular applications involving repetitive use, you may prefer one of 15 special-purpose guards to adapt the versatile Stud Driver to *your* job requirement!



JUST SQUEEZE TRIGGER to anchor conduit clips to concrete walls and ceilings with this *new* Stud Driver! You can take the tool anywhere, use it anywhere for all your light, medium and heavy-duty fastening jobs.

Exclusive Remington Captive Stud Guard Assembly has new "*Safety-Zone*"



Heart of the Captive Stud Assembly is combination of square-headed piston and aluminum alloy buffer. Piston is abruptly halted by buffer when base material is inadequate to stop the stud. Remember: If it's the Remington Captive Stud tool, it's the safest Stud Driver on the market!

Remington DU PONT

STUD DRIVER

Remington Arms Company, Inc., Bridgeport 2, Connecticut

Mail coupon for free booklets

Industrial Sales Division,
Dept. EC4
Remington Arms Company, Inc.
Bridgeport 2, Connecticut

Please send information about the new Remington Stud Driver and Model 440 Captive Stud Guard Assembly.

Name.....

Firm.....*Position*.....

Address.....

City.....*State*.....

Now another electrical system more profits—built and

Now, with a complete new fire detection and alarm system, Honeywell again adds to its growing line of systems for electrical contractors.

With each of Honeywell's electrical systems you get the kind of support that's never been offered in this field before.

Honeywell helps you plan and install the system, checks it out for you and provides complete service during your guarantee period.

New Honeywell W237 Fire Alarm Panel

This new fire detection and alarm system is ideally suited to reporting fires automatically, both within the building and to the local fire station.

It offers these unique features—

- More dependable—transmits alarms even with a ground or break in detection circuit.
- Positively locates fire by numbered light—not necessary to count bell strokes to identify zone.
- Stand-by battery provides protection even when power fails.
- Automatic detectors fit standard 3" outlet box or plaster ring.

For complete details of Honeywell's fire detection and alarm system, just fill out and mail the coupon on the opposite page.

to help you get larger contracts, backed by Honeywell

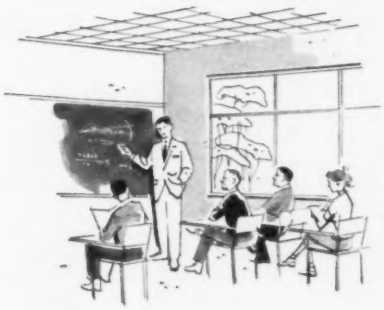
Hotel/Motel Master* puts up to 24 separate functions under one-man control

This system brings hotel and motel operators labor saving and extra convenience plus better service for guests. Already installed in some of the country's smartest new hotels and motels, this system uses incoming information and outgoing command signals to provide efficient front desk supervision over maid service, guest room status, lighting, air conditioning and many other functions. Each installation has proved electrical signals cheaper and faster than footsteps.

Light Saver* gives precise light control, helps cut electric bills!

With this Honeywell system, modern daylighting really pays off for the user. Tests prove savings on electricity for lighting run as high as 80%.

Each building is zoned so that the artificial lighting for each room is equal in any zone. Phototubes sense the daylight coming into each zone, actuate precise Honeywell controls and switches to turn up artificial lights as they are needed, turn them off when they are no longer necessary. When complete darkness is desired, entire system is turned off by a manual switch in the room. Lighting returns automatically to phototube control when switch is turned on.



*Trademark

Honeywell

Honeywell First in Controls

Free—Honeywell Literature with this coupon!
MINNEAPOLIS-HONEYWELL
Dept. EC-4-80,
Minneapolis 8, Minnesota
Please send me more information on:

- ☐ Honeywell Fire Detection and Alarm System
- ☐ Honeywell Light Saver
- ☐ Honeywell Hotel/Motel Master

*Name*_____

*Address*_____

*City*_____ *State*_____

neutral and any fixtures or wire enclosures which must be grounded within the building. This will make it necessary to either run a grounding conductor back with the circuit conductors to the neutral terminal in the service or to connect a tie between the existing copper water pipe and this same ground electrode used to ground the neutral.—G.R.

Grounding Receptacles —Terminal Connections

Q. *Section 2115-b states in part: "Where a grounding receptacle is required—the branch circuit or branch circuit raceway shall include or provide a grounding conductor to which the grounding contacts of the grounding receptacle shall be connected". My question is: Do the words "shall be connected", as used above, require a jumper from the grounding screw terminal on the receptacle body to the outlet box, where the wiring system is metallic conduit, or do the receptacle mounting screws constitute adequate connection, since they are in contact with the box and the grounded receptacle shell?—D.J.N.*

A. While the Code does not specifically state the method of connecting the grounding conductor to the grounding terminal of the receptacle, it appears evident that such a connection is automatically provided when a metallic system of wiring is used. Since the supporting yoke of the receptacle is connected to the grounding terminals, a path to ground is provided through the small receptacle screws which are used to secure the receptacle to the outlet box. This method of connection is recognized in the Abbott and Smith N. E. Code Handbook, and also by some of our manufacturers in their advertisements. While such procedure may be questioned on some masonry installations, where box threads are covered with plaster, many of our receptacles are provided with plaster-cleaning mounting screws which assures good contact between the screw and the outlet box. It is also significant to note that the principle of grounding through the mounting screws is recognized when adapters are used on grounding type caps to provide a means of connection to a conventional type of receptacle. In the case of a metallic system of wiring, we have fittings designed and approved to provide adequate ground continuity. We have reasonable assurance that the box is adequately grounded through the metallic wiring method serving same. In view of the foregoing, it appears that no wiring jumper is required to connect the grounding terminal of the receptacle to the outlet box.

In the case of a non-metallic system of wiring provided with a grounding conductor, it may be contended that we have a similar situation when this grounding conductor is properly connected to the metallic outlet box. Under such conditions the box would be grounded the same as the box used with a metallic system of wiring, and if we are consistent the procedure of grounding the grounding receptacle terminal through the metal screw should be recognized. If this reasoning is correct, it appears that the UL approved, rugged grounding terminal has no application other than presented by the use of a non-metallic outlet box. This immediately raises the question, why are the grounding terminals required on all of the grounding types of receptacles? If they serve no useful purpose under the conditions above described, why should they be provided?

In answer to these questions there is no UL approved method, that I know of, for connecting the grounding conductor of a non-metallic system of wiring, to the metal box. Sometimes the grounding conductor is wrapped around the cable under the cable connector. In some cases bolts, nuts and washers are installed by the contractor on the job. In some cases the grounding conductor is wrapped around a box supporting screw. In the absence of boxes provided with an UL approved terminal for the grounding conductors, I would hesitate to accept some of the makeshift methods of grounding the outlet box as adequate ground continuity for the grounding of portable appliances. It therefore follows that the grounding conductor of the non-metallic cable should be brought direct to the grounding terminal of the receptacle. In this case the box would be grounded through the receptacle supporting screw. This procedure appears to be the one generally required by inspection authorities. There is however a vulnerable spot with such procedure. We must recognize the fact that receptacles are devices which may be replaced by the householder who has little, if any, concept of the important function of a grounding conductor. When a grounding type of receptacle is replaced with an ordinary receptacle, it is reasonable to assume that the grounding connection to other boxes on the circuit will be broken, and if any grounding type of receptacles are connected to such boxes the safeguard originally intended and provided will be lost, and a false concept of safety will prevail. While the Code cannot provide for all contingencies, it appears reasonable to assume that when a life hazard is involved some recognition should be given.

In order to satisfy this critical observation, it appears to me that our manufacturers should provide a UL approved grounding terminal or terminals in their outlet boxes so that the ground continuity through the box to other boxes would be assured regardless of the replacement of receptacles. Such a terminal would also assure a properly grounded box and eliminate the necessity for the makeshift methods now in use. Under such conditions the ground connection to the grounding conductor could be obtained through the receptacle supporting screw. Such a connection however should be recognized by the code.—B.A.McD.

Bakelite Bushings

Q. *We have just completed a rewiring job in which we not only increased circuits but also added a complete new service using auxiliary gutters between the component parts of the service and distribution center with the various cabinets attached to this gutter by means of conduit nipples. To protect the insulation on the wire, we used bakelite bushings and now the inspector tells us that such bushings cannot be used unless a locknut is placed under them. As we can find nothing under Article 374 covering auxiliary gutters which makes such a requirement, we are wondering if the inspector is correct.—P.R.N.*

A. Under paragraph c. of Section 3749 you will note the following sentence: "Suitable bushings, shields or fittings having smooth rounded edges shall be provided where conductors pass between gutters through partitions, around bends, between gutters and cabinets or junction boxes and at other locations where necessary to prevent abrasion of the insulation of the conductors."

Put National Electric
Xduct Junior EMT to the

ONE SURE FISH TEST... TRY IT YOURSELF

A special enamel inside coating gives National Electric Xduct Junior EMT its superior fishing qualities.

This specially developed inner wall finish not only protects the interior of the conduit against corrosion but provides a smooth slick surface that reduces friction between conduit walls and wires to a minimum. Actual fish tests on 6 leading types of conduit conducted by "on the job" electricians proved Xduct Junior more than twice as easy to start and far easier on the constant pull.

Try fishing Xduct Junior yourself.

In addition—NE Xduct Junior is easy bending. It's made of a high quality, very ductile metallic tubing. When properly bent, Xduct Junior will not flatten at the bend.

NE Xduct Junior has full zinc protection. Every length is silver-bright, with an electrogalvanized protective zinc coating that will not flake or crack.

Listed by Underwriters' Laboratories, Inc.

National Electric Products

PITTSBURGH, PA.

2 Plants • 12 Warehouses • 41 Sales Offices

Westinghouse Releases
HIGHWAY
LIGHTING
ENGINEERING
GUIDE

FIRST HIGHWAY LIGHTING ENGINEERING GUIDE

FREE to Engineers—Contractors—
Highway Departments—to Help Speed
"Programming" of America's New Highways!

Interstate Highway progress indicates huge "Programming" projects—in all but a few states—*expected soon!*

Engineers, literally by the thousands, will soon be detailing highway plans to accommodate 1975 traffic!—for travel at speeds of 70 miles per hour or more! —and for driving as *safe* during nighttime as it can be in bright daylight!

To aid this work—Westinghouse has now compiled the *first* HIGHWAY LIGHTING ENGINEERING GUIDE ever published!

This book distinguishes highway-lighting techniques from those used in lighting streets! It presents illustrations, technical data, recommended layouts and the various types of luminaires preferred for each critical highway-lighting problem.

It enumerates relative lighting costs —giving examples of well-known Westinghouse highway installations.

It summarizes all data necessary to select the correct light source—the proper optical system—and the most suitable electrical components. Furthermore, this book provides a simplified form to help you organize your own lighting-analysis calculations.

A COPY IS YOURS BY RETURN MAIL

This book contains all the information available from Westinghouse exclusive experience and knowledge—gained in having consistently led all others in the design and development of utmost efficient roadway lighting—at lowest practical costs!

To get your copy—simply address Westinghouse Electric Corporation, LIGHTING DIVISION, Highway Lighting Department, Edgewater Park, Cleveland, Ohio. DO IT TODAY! J-04449

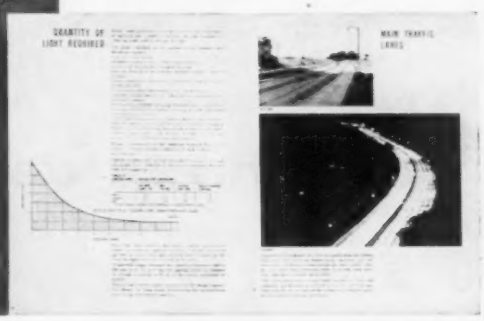
Every Assistance Volunteered to All State, Municipal and Consulting Engineers of Highway Lighting

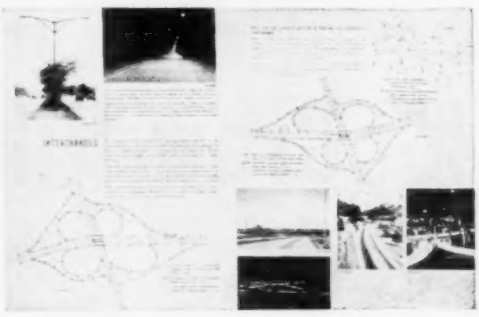
There are Westinghouse Roadway Lighting Engineers throughout the country to aid in solving all technical highway-lighting problems. You are welcome to capitalize on the knowledge, experience and abilities of these men at any stage whatsoever of highway planning, construction or installation.

Moreover, Westinghouse makes scientifically superior luminaires for every type application—provides all electrical components, including: transformers, oil switches, controls and poles.

Westinghouse will help you get the best possible combination of all components for each specific situation—consistent with the lowest possible practical costs today!

YOU CAN BE SURE...IF IT'S **Westinghouse**





The Year Advertising Helped

This editorial message was first published by McGraw-Hill two years ago. It describes advertising's dramatic contribution to the American economy during 1954. The theme of the editorial—that advertising can help promote economic stability by stimulating sales at a crucial time—is even more pertinent today.

As our economy grows, it is constantly changing. The conditions business faces today are not the same in every respect as those it faced in 1954. But business again has the opportunity, through advertising and other selling efforts, to help sustain a high level of economic activity. At the same time, it will be building markets for the period of renewed expansion that is sure to follow.

This editorial is reprinted exactly as it appeared in 1956 except for minor editorial changes to bring it up to date. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

McGraw-Hill Publishing Company, Inc.

IN 1954 we had a business recession in the United States. Sales fell about 4% during the year. If management had followed the historic pattern of business ups and downs, advertising volume would have fallen much further.

But in 1954 the volume of advertising did not fall. It increased over 5%, and expenditures in all major advertising media rose. Every effort was made to stimulate sales when sales were needed to sustain prosperity.

This was something entirely new under the sun. It had a powerful influence in making the recession of 1953-54 one of the mildest on record. It helped greatly to speed business on to the record-breaking levels it attained in the years 1955-57.

There are several reasons why America's business management attacked this decline in sales with more advertising. One of them grew out of the greatly strengthened position of the American consuming market. Consumers' income after taxes has been rising an average of over $10 billion a year since 1946, and this rising income is more widely distributed than ever before. Furthermore, consumers had piled up reserves of about $200 billion in cash or its equivalent. These reserves offered a new and powerful inducement to increased selling and advertising effort even in the face of a possible decline in consumer income. (At the end of 1957, consumer reserves were $225 billion.)

Taking the Longer View

However, the principal reason why a sales decline was attacked with increased advertising is management's new-found conviction that good advertising is essentially an investment in the development of a market. Successful development requires sustained investment. The inclination of business management to take this longer view is, of course, motivated

McGraw-Hill PUBLISHING COMPANY,

ABP HEADQUARTERS FOR

Kill a Business Recession

by the fact that the American market, with over 3 million consumers being added annually, is growing at a prodigious rate.

Ten years ago only a handful of companies had plans for investment in new producing facilities extending beyond the current year. Today almost all leading companies have investment programs running some years ahead. And keeping pace with these long-range investment plans has been the development of sales and advertising programs to reach tomorrow's greatly expanded markets.

Advertising's Key Role

This crucial role of advertising in providing driving power for our economy is gaining greater recognition every day. In his book, "People of Plenty," Professor David M. Potter of Yale University remarked: "Advertising is not badly needed in an economy of scarcity, because total demand is usually equal to or in excess of total supply, and every producer can normally sell as much as he produces. It is when potential supply outstrips demand—that is, when abundance prevails—that advertising begins to fulfill a really essential economic function."

Today abundance so completely prevails in the United States that it has been conservatively estimated that as much as a third of everything offered for sale falls in the realm of "optional consumption." That is, consumers can "take it or leave it" without any immediate personal inconvenience. But if they decide to "leave it," a terrific economic depression will not be far behind. In such circumstances, advertising—in which, in all of its forms, we are now investing over $10 billion annually—clearly is of crucial importance to our continued prosperity.

In performing its key role in past years, American advertising never realized its full potential. It successfully promoted sales. But it never was called upon to promote an overall economic stability as a direct outgrowth of increased sales.

By successfully promoting both sales and economic stability, as it did in 1954, advertising surely has added new strength to the American economy. It has also added a great new and constructive dimension to advertising itself.

One of the surest means of expanding your sales volume in today's industrial markets is through dominant advertising in the publications directly serving your major customers and prospects.

McGraw-Hill's business and technical publications can give you quick access to the men who initiate, specify and approve the purchases of industrial products and services. Because all are leaders in their respective fields, you are assured a maximum return on your advertising investment when you *concentrate* in the McGraw-Hill publications serving your most important markets.

INCORPORATED · 330 West 42nd St., New York 36, N. Y.

BUSINESS INFORMATION

TRADEMARK OF SAFETY

ELECTROMODE All-Electric HEATERS

Mr. Safety Grid

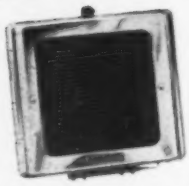
Only Electromode Heaters have the Safety Grid —a cast-aluminum heating element with all electric wires completely sealed inside. Provides full protection against fire, shock or burn.

ELECTROMODE BASEBOARD HEATERS

- EASY TO INSTALL
- NO CALL BACKS
- SATISFIED USERS

All Your Requirements from One Reliable Source

Electromode Heaters Are Made in More Than 100 Different Models. Write for Full Information.

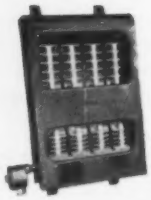


ELECTROMODE WALL-TYPE BATHROOM HEATER

ELECTROMODE WALL-TYPE DOWN-FLO HEATER

ELECTROMODE RADIANT CABLE HEAT

ELECTROMODE PORTABLE and SUSPENSION HEATER



ELECTROMODE EXPLOSION-PROOF HEATER

ELECTROMODE SUSPENSION-TYPE HEATER

ELECTROMODE division, Commercial Controls Corporation

DEPT. ECM-58 ROCHESTER 3, N. Y.

Then under paragraph b. of Section 3736 covering construction of gutters, the last sentence reads as follows:

"If conduit bushings are constructed wholly of insulating material, a locknut shall be provided both inside and outside the enclosure to which the conduit is attached."

The locknut is necessary to remove strain which might otherwise be placed on a composition or plastic bushing.—G.R.

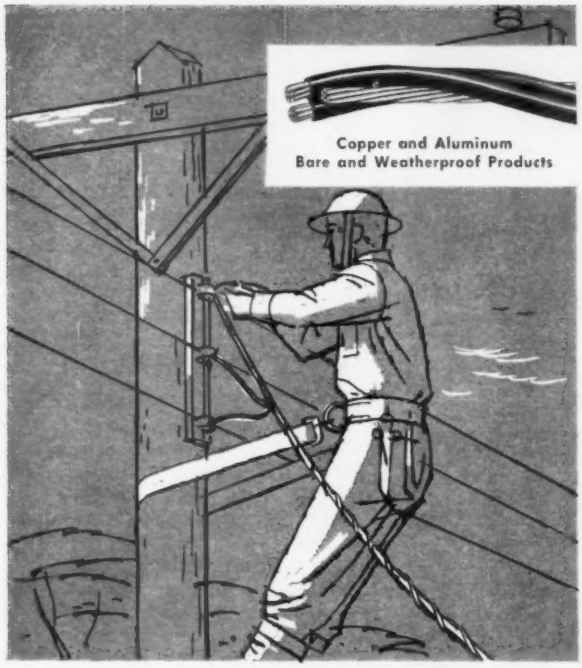
Condulets Used as Outlet Boxes

Q. *Section 3007 of the National Electrical Code reads in part as follows: "Except as permitted in Sections 3369 and 4179, a box shall be installed at each outlet, switch or junction point of conduit, electrical metallic tubing—(etc.)" My question is: As used in this section, how is the term "box" defined? Specifically, does it include the type of fitting commonly known as a "Condulet", and referred to, according to the configuration of the conduit hubs, as an "LB", "LR", "Tee", etc?—D.J.N.*

A. While the code does not definitely establish the status of a Condulet as an outlet box, Section 3709-c which reads as follows indicates that such is the case:

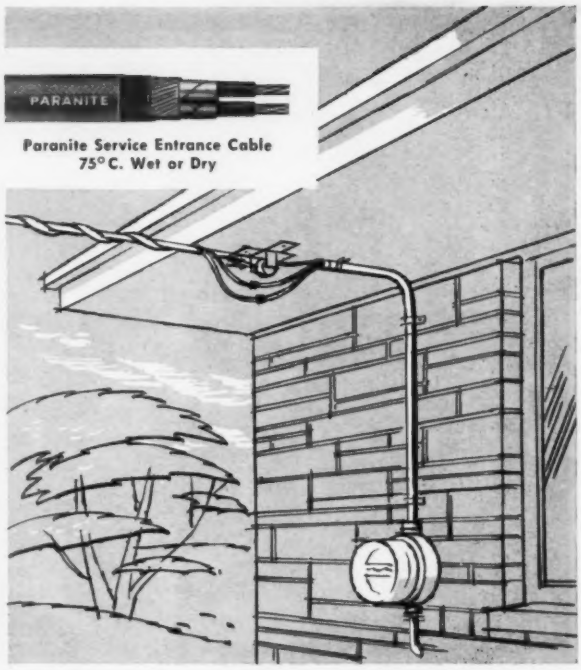
"Section 3709-c. The limitations in paragraph (a) and (b) of this Section shall not apply to terminal housings supplied with motors, nor to types of boxes or fittings without knockout and having hubs or recessed parts for terminal bushings and locknuts".

It is also significant to note that Condulets are listed, under the general heading of "Outlet Boxes and Fittings" by the Underwriters' Laboratories. See Page 239 of the U. L. Electrical Construction Materials List. This listing indicates that the provisions of Section 3007 are satisfied when any of the listed Condulets are used as outlet boxes. Reference to the Crouse Hinds catalogue also shows that several types of wiring outlet devices such as attachment plug receptacles, lamp receptacles and cord rosettes have been designed for direct connection to the Condulet in place of the ordinary cover. Another application which has been used extensively is a Type T Condulet where a conduit nipple supporting a fix-



Copper and Aluminum
Bare and Weatherproof Products

Paranite Service Entrance Cable
75° C. Wet or Dry



From Source to Service with ®

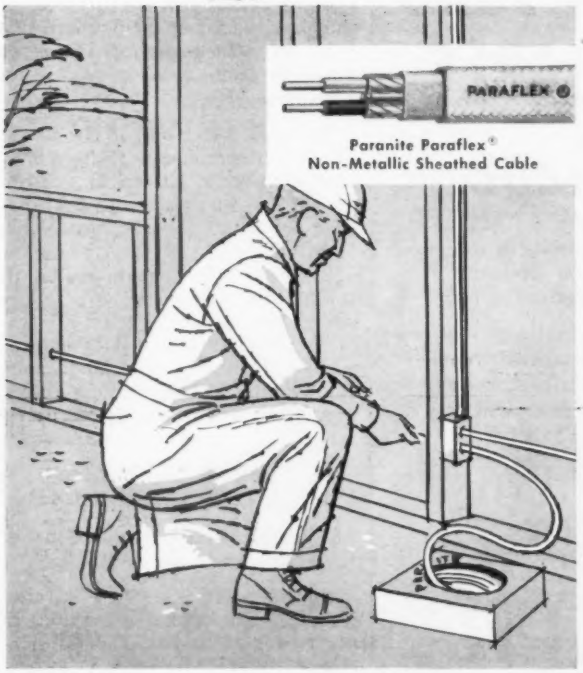
PARANITE

PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation

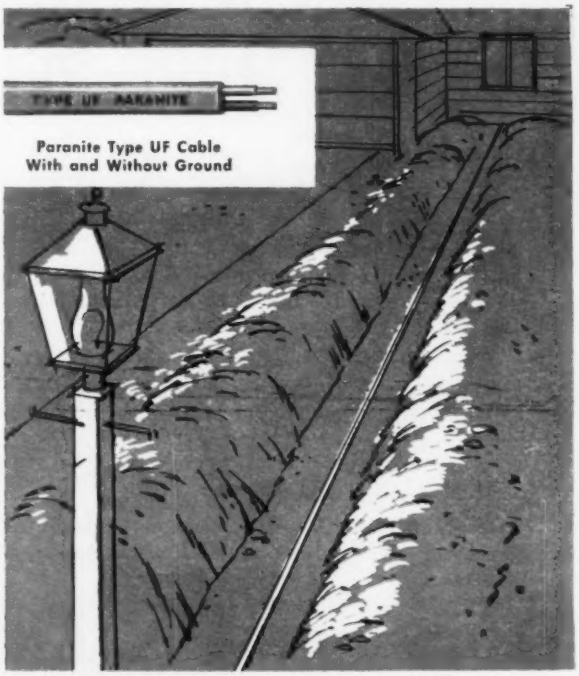
FORT WAYNE 6, INDIANA

MANUFACTURING PLANTS: Birmingham, Alabama; Anaheim, California; Jonesboro, Indiana; Marion, Indiana; Tiffin, Ohio



Paranite Paraflex®
Non-Metallic Sheathed Cable

Paranite Type UF Cable
With and Without Ground



Sales Offices in all Principal Cities . . . Sold only through Recognized Electrical Distributors

MAKE THESE WIRING JOBS FASTER, MORE RELIABLE with *Porter*® Vinyl Tape

Here's a brand-new single-wind electrical tape with an improved vinyl backing, made especially to speed up your junction-box and other tight-spot wiring jobs. Also ideal for insulating tools—no outer wrap needed.

Porter Vinyl Tape conforms quickly and permanently to irregular surfaces. This property, along with a new high-tack adhesive, saves you time and space in tight places where one-wrap, compact winding is a must. And, after it's installed, it stays flexible at low temperatures, resists damage from chemicals, abrasion, and heat.

FOR FULL INFORMATION on new Porter Vinyl Tape, write *Quaker Rubber Division, H. K. Porter Company, Inc.; Philadelphia 24, Pa., or Pittsburg, California.*

H. K. PORTER COMPANY, INC.
QUAKER RUBBER DIVISION

ture is screwed into the center hub.

In view of the foregoing, it appears to me that Condulets, both from a code and UL standpoint, may be used as outlet boxes, and my field experience over the years indicates that they have been accepted in various sections of our country for such use.—B.A.McD.

NEC Official Interpretations

The Electrical Correlating Committee of the National Fire Protection Association has released a series of five official interpretations of the 1956 National Electrical Code. These were effective January 9, 1958.

The interpretations cover the following subjects: clearance of service drops; installation of EMT in concrete; panelboard protection; current-limiting devices; and single-pole circuit breakers as disconnecting means.

Official texts of the interpretations follow.

INTERPRETATION No. 443

ARTICLE 230—Clearance of Service Drops.

Question No. 1—Does the retaining of the words "in general" at the beginning of Section 2324 of the 1956 National Electrical Code and the revision in the wording of the last sentence still permit a point of attachment of less than ten (10) feet?

Answer—No.

Question No. 2—Is it the intent of the last sentence in Section 2324 of the National Electrical Code to permit a reduction in the clearance over residential driveways only from eighteen (18) feet to twelve (12) feet with a maintaining of the eighteen (18) feet over alleys and public roads and ten (10) feet over sidewalks where it is impracticable to attach to a point sufficiently high to obtain the eighteen (18) feet over residential driveways?

Answer—Yes.

INTERPRETATION NO. 444

SECTION 3482—Installation of EMT in Concrete.

Question—If ½ in. or ¾ in. electrical metallic tubing is installed in the center of a 4-in. slab of noncinder concrete in direct contact with the earth, with sand and gravel

fill, would this be prohibited by Item 2 in Section 3482 of the 1956 Code?

Answer—No.

INTERPRETATION NO. 445

SECTION 3883—Panelboard Protection.

Question—Does paragraph "a" of Section 3883 apply to a 200-ampere circuit breaker lighting and appliance branch circuit panelboard installed in a dead-front switchboard section with a 400-ampere service switch and fuse providing the only overcurrent protection ahead of it, where both the panelboard and the dead-front switchboard, in which it is incorporated, have been inspected and labeled by a laboratory of recognized standing prior to shipment from the factory?

Answer—No.

INTERPRETATION NO. 446

SECTION 1109—Current Limiting Devices.

Statement—A 3-phase, 120/208-volt, 4-wire, grounded wye system is being used to supply an auditorium. The anticipated short circuit current is above the 10,000-ampere maximum for which standard National Electrical Code fuses and branch-circuit and service-circuit breakers are normally tested.

Question—Is it the intent of Section 1109 of the 1956 edition of the National Electrical Code that all overcurrent devices in such a system be capable of interrupting safely the maximum short-circuit current which can occur at the point in the system where the particular overcurrent protective device is located?

Answer—Yes, but this might be achieved by the provision of current limiting devices ahead of the conventional branch circuit protection and would not necessarily require that the branch circuit protective devices have current interrupting capacities in excess of the values for which they are normally tested.

INTERPRETATION NO. 448

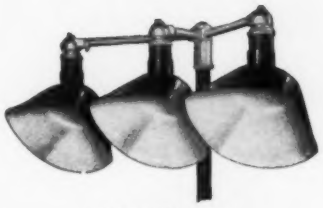
SECTION 2351—Single-Pole Circuit Breakers as Disconnecting Means.

Question—Is it the intent of Section 2351 to recognize as one of the six disconnecting means, two single-pole circuit breakers on the same side of the line and controlling two 2-wire circuits?

Answer—No.

The name to remember every time you have a floodlighting job.

SCOOP



RECTANGULAR

ELLIPTICAL

These units have everything in design, illumination, durability and good appearance so that every installation is a sucessful one. You can always be sure that these easy to install units with their individual light control, will do the best kind of a lighting job. Here is the quality that keeps QUAD Floodlighting units sold. Keep the name QUAD in mind so that you always have the right floodlighting answer.

•

The user gets individual light control with each unit which can be turned or tilted in any direction. A single head bolt permits adjustment of 180 degrees horizontally and 40 degrees vertically. Units of various sizes and types can be removed or interchanged without disturbing the wiring.

•

Ask for catalog 9-A

QUADRANGLE MFG. CO.

325 S. PEORIA ST. CHICAGO 7, ILL.

Along today's modern highways easy-to-handle J-M Transite Ducts provide installation economies and years of service life, protecting traffic-signal, lighting, and other power-service circuits.

J-M Transite® Ducts install fast to last... give complete cable protection.

Because speed and economy set the pace in today's highway programs, more and more highway cables are going into Johns-Manville Transite Ducts.

For speed, Johns-Manville Transite Ducts are strong, light and long—easy to handle and install. Workmen set 10-foot lengths in place easily, join them up tight in seconds with snug-fitting J-M Plastic Couplings, and Transite's smooth bore is free of burrs and other obstructions that may interfere or cause damage during pulling of cables.

For economy, J-M asbestos-cement Transite Ducts go in to stay. Non-conductive Transite is not affected by electrolysis—resists the corrosive action of fills or high-salt soils in permanently damp locations. Millions of feet of installed Transite Ducts have proved that Transite withstands earth loads and soil stress... resists vibration and shock from highway traffic.

Let us send you free Transite Duct brochure EL-29A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville Asbestos Transite Ducts can be laid directly in trench without concrete envelope or other mechanical protection.

JOHNS-MANVILLE Transite Ducts
Made of Asbestos-Cement
J-M Conduit for direct buried banks and exposed runs
J-M Korduct® for concrete banks

Lighting Exposition Held in New York

The 1st National Lighting Exposition, sponsored by the Lighting Lamps and Electrical Manufacturers Salesmen's Association, Inc., and held in New York City's new Coliseum March 9-12, attracted over 12,500 architects, designers, engineers, contractors and electric utility people from 33 states and six foreign countries. Over 7000 types of light sources and lighting units were displayed in 136 booths by 132 different lighting firms. Also, there was a record registration of 3700 for the three-day series of ten symposiums, conducted by noted U. S. and Canadian authorities in the major fields of lighting, design and architecture.

Expressed objective of the exposition was to form a part of a broad program by the lighting industry designed to accelerate study, and remedy sub-standard lighting conditions nationally, which plague three out of four schools, two out of three offices, stores and factories, and approximately four out of every five homes.

The lighting symposiums played a prominent part in meeting the exposition objective, as did the many outstanding exhibits. The symposiums covered such subjects as office and school lighting, street and highway lighting, theatrical lighting, lighting for industry, light for selling, lighting for public recreation, lighting techniques for public institutions, and use of color and lighting in merchandising and industry. Each symposium was further conducted by an authority in the specific field, and lively question and answer sessions followed the brief but strong talks given on each subject.

Three lighting symposiums were held on the first day, one on office lighting, one on school lighting, and one on street and highway lighting. R. G. Slauer, manager of Lighting Fixture Division, Sylvania Electric Products Inc., discussed office lighting. Lighting results are the criterion by which an office lighting installation should be judged, he said. He first discussed the "why" of good office lighting, and said that people respond to color, and environment, and need much more in an office lighting system than merely providing light to see. Office lighting is for two different types of offices, he stated, the "pool" office, and the individual office. In the "pool" office, we go for averages, which is bad practice, he said. We should provide lighting which will take care of the majority, he pointed out. In individual offices, the lighting should be tailored for the individual who is going to use it, Mr. Slauer said. He further reviewed the physical aspects of lighting, such as louver ceilings, use of "hung" ceilings, need to locate partitions any place where needed, which is helping to promote modular treatments, and use of a variety of services within a room—acoustics, sprinkler heads, air conditioning. He also stressed the monotony that has crept into office lighting practices, and offered suggestions for eliminating it, or of altering it with more variety.

NEW YORKERS won seven awards in the 1957 International Lighting Competition, which were presented at an Outdoor Lighting Forum dinner meeting sponsored by the New York Section of the Illuminating Engineering Society. Shown in photo are (l to r): L. C. Messick, manager, National Lighting Bureau, who presented Certified Lighting Certificates; John L. Moosian, District Engineer, Public Buildings Services, General Services Administration; Mathew Veeck, Consolidated Edison Co. of N. Y., Inc.; Ralph T. Franco, General Electric Supply Co.; J. Gordon Carr, architect; T. M. Sullivan, chief, Aviation Planning Division, Port of New York Authority; and W. W. Garey, publisher, Electrical Construction and Maintenance, who presented the contest award certificates for the sponsors.

ELECTRICAL CONTRACTORS in Philadelphia set the record for the nation, by winning a total of eight prize awards in the 1957 International Lighting Competition. Certificates were presented at a Lighting Awards dinner meeting in Philadelphia. Winners were (l to r): Albert Weiner, C & D Batteries; Edward D. Barber, Independent Wiring Co. (2 prizes); Charles A. Holm; A. Walker, Union Electric Contracting Co.; Harry Farber, Harry M. Farber & Bros.; and Robert Smith. W. W. Garey (right), publisher of Electrical Construction and Maintenance, presented the awards on behalf of the sponsors.

INDIVIDUAL PROTECTION STATIONS

SAFELETS

now available with a wide variety of receptacles and circuit breaker ratings

The Heinemann Safelet is a compact unit that neatly combines circuit-breaker safety with plug-in convenience. It has hundreds of applications, can be used for the individual protection of power tools, fractional horsepower motors and almost all general appliances.

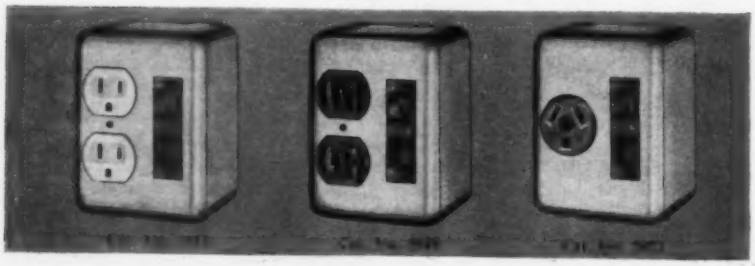
Now you can have the Safelet with any of a large number of receptacles, single and duplex, in twist-lock, polarized, "T" slot and other styles.

And now you can have a wide choice of circuit breaker ratings: from 6 to 50 amperes, at the most commonly used a-c and d-c voltages.

The Safelet enclosure is made of 16-gauge steel with an attractive grey hammertone finish. Units are available for either flush or surface mounting.

Of course, the circuit breakers used are Heinemann breakers . . . long accepted by the electrical industry as the standard of performance.

For full details, send for Bulletin 1000.



HEINEMANN

ELECTRIC COMPANY

132 Plum Street Trenton 2, N. J.

S.A. 1989

FIRST PRIZE award certificate in the Electrical Contractor division, Residential Lighting classification, of the 1957 International Lighting Competition, was presented to (l to r) Herbert Snyder and Charles R. Jordan of Snyder Electric Service, Greensboro, N. C., Prize covered the lighting in a model Electric-Living home in Greensboro, N. C. Award was presented by Berlon C. Cooper (right), eastern editor, Electrical Construction and Maintenance, on behalf of the contest sponsors—Naticnal Lighting Bureau and three McGraw-Hill electrical publications.

Street and highway lighting principles and practices were discussed by George Nagel, Connecticut Department of Highways and supervising engineer on lighting for the new Connecticut Throughway. Mr. Nagel discussed the importance of highway lighting, for improved safety in driving, and for prevention of accidents, and outlined the basic lighting principles involved in highway lighting. He demonstrated by movies that highway lighting is principally by silhouette, and showed a film featuring the mile-long lighting test area used as a pilot installation for guidance in selecting the lighting for the new 53-mile long Connecticut Throughway.

J. M. Chorlton, superintendent of Maintenance and Construction for the Toronto (Canada) Board of Education, discussed school lighting. In his talk he stressed the need for more illumination of higher quality for school classrooms, and predicted that the new Illuminating Engineering Society recommended practices for school lighting will require 70 footcandles as the minimum for school classrooms, as contrasted with 30 footcandles in the current recommended practices. By means of moving pictures he showed various types of lighting systems in use in Toronto schools, and appraised the qualities and shortcomings of each. He stressed the use of supplementary chalk board lighting, and showed various solutions to this problem. In general, three rows of fluorescent lighting units are required for the average size classroom, regardless of

whether recessed troffers, surface mounted or pendant-type of units are used, he said.

Four symposiums were presented on the second day of the exposition, and covered background lighting for homes, theatrical lighting, lighting for industry, and lighting for selling.

Thomas Smith Kelly, lighting consultant, gave a slide-illustrated talk on background lighting for homes. First, he reviewed the various seeing problems encountered in the home, and discussed some of the activities which occur in the average home. Then, by means of slides, he illustrated and discussed various lighting techniques which have been used to provide a low level of general background lighting in the home. Superimposed on this low level illumination are higher levels of lighting for specific critical seeing tasks.

Stanley McCandless, professor of lighting at Yale University and consultant to Century Lighting, Inc., handled the symposium on theatrical lighting. He covered the basic principles of using directional beams of light to highlight the players, and of accenting or playing down form by means of highlights and shadows. How these principles can be interpreted in equipments, and use of dimmer controls as an adjunct, were further described in detail.

Peter Muller-Munk, industrial designer, gave a highly interesting

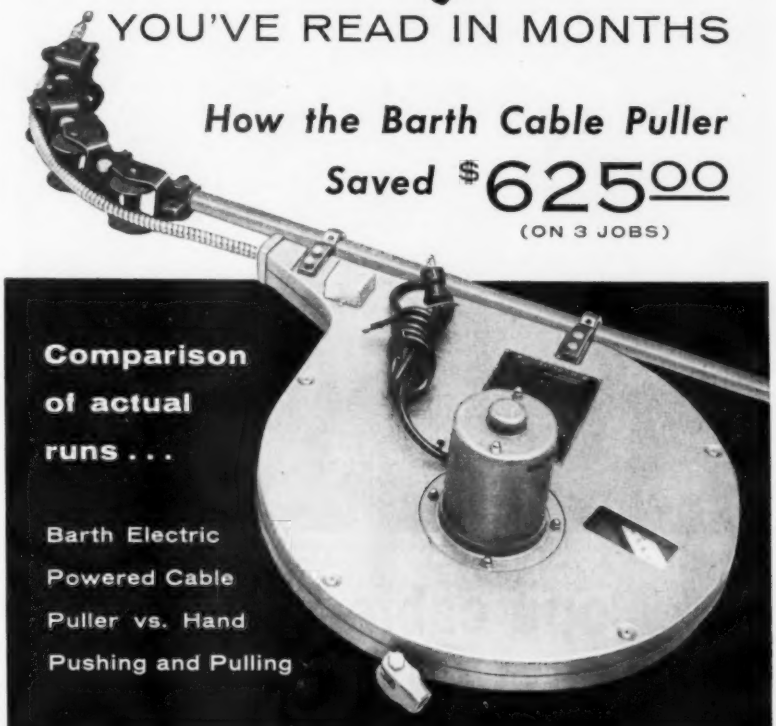
AWARD WINNER in 1957 International Lighting Contest in Baltimore was H. M. White (center), lighting engineer with Baltimore Gas & Electric Co., who won Honorable Mention for office lighting installation in Weaver Bros. real estate office. A Certified Lighting Certificate of Conformance awarded to Weaver Bros., owners, was accepted by Lawrence A. Menefee, (left), Baltimore architect for the project, on behalf of the owners. Certificates were presented by Berlon C. Cooper, contest chairman, representing the sponsors, at the February meeting of the Baltimore Section of the Illuminating Engineering Society.

THE MOST IMPORTANT

Business Information

YOU'VE READ IN MONTHS

How the Barth Cable Puller Saved $625.00 (ON 3 JOBS)



Comparison of actual runs . . .

Barth Electric Powered Cable Puller vs. Hand Pushing and Pulling

DESCRIPTION OF ACTUAL RUNS PULLED	Est. Hand Pulling	BARTH Cable Puller	Savings at $5.00 Per Hour
3 - 500 — 90 Feet in 3" Pipe — 2 Ells — 15' Rise 3 - 3/0 — 100 Feet in 2" Pipe — 2 Ells — 15' Rise 3 - 3/0 — 50 Feet in 2" Pipe — 1 Ell — 1 Offset	30 Man Hours	10 Man Hours	$100.00
3 - 500 — 120 Feet in 3" Pipe — 2 Ells — 10' Rise 3 - 500 — 80 Feet in 3" Pipe — 2 Ells — 10' Rise 3 - 4/0 — 160 Feet in 2" Pipe — 2 Ells — 10' Rise	60 Man Hours	10 Man Hours	$250.00
3 - 1/0 — 140 Feet in 2" Pipe — 2 Ells — 1 Offset 4 - 3/0 — 140 Feet in 2½" Pipe — 2 Ells — 1 Offset Plus nine other similar runs	85 Man Hours	30 Man Hours	$275.00

YOU CAN SAVE MONEY—TIME—ENERGY

—only the Barth Cable Puller pushes tape and pulls wire electrically!

THE BARTH CORPORATION 12664 Brookpark Road • Cleveland 30, Ohio

Please send the complete Cable Puller Data Folder and prices.

NAME_____ YOUR COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Each of the two illustrated troughs can carry as much cable as all of the paralleling conduit.

Cope cable trough saves steel by the ton!

Problem. 100 miles of cable to be supported in a New Jersey power generating station.

Solution. A careful cost analysis of available methods and materials convinced plant engineers that Cope's expanded-metal cable trough was the best choice. Why? Among other reasons, it meant a saving of more than a ton of steel for every 60 feet of trough installed, as compared to conduit . . . a total saving in excess of 250 tons of steel for the 15,000 ft. of trough required for the completed job!

Here's How You Save. *One* 10 foot section of 24" width Cope trough supports as many cables as 16 lengths of 4" conduit and it only weighs 54 lbs., compared to 575 lbs. for this same amount of conduit. This adds up to real economy regardless of the size of your installation. Cope's expanded-metal cable trough simply uses *less* steel to do the job and obviously this can mean substantial savings for you!

Cuts Labor and Maintenance Costs, Too. Design and construction features of lightweight Cope trough speed installation of space saving systems—even in the most cramped quarters. Easy-to-get-at trough simplifies cable inspection and repair . . . provides ready re-routing and facilitates system additions.

You save *three* ways when you specify Cope cable supporting equipment . . . trough, ladder or channel.

- **LOWER FIRST COST**
- **LOWER INSTALLATION COSTS**
- **LOWER SYSTEM MAINTENANCE COSTS**

Discuss these advantages for *your* installation with a qualified Cope representative—or write to T. J. Cope Division, Rome Cable Corporation, Collegeville, Pa.

1000

T. J. COPE *Division*

ROME CABLE CORPORATION

HOUSTON, TEXAS, was the scene of this presentation of award certificates to winners in the 1957 International Lighting Competition. A total of five awards were won by joint entries of H. G. Hrivnatz (extreme right), Houston Light and Power Company, and S. J. Brochstein, store designer, second from right. At left is J. F. McPartland of Electrical Construction and Maintenance, making the presentation, and Mr. Brochstein's brother who is a partner in Brochstein, Inc.

talk on "A Designer's Approach to Commercial Lighting". In discussing the relation of design to lighting installations, he pointed out that light must be considered not only as a measurable quantity in space, but also in its effect on the architectural function of this space and on the psychological effect on people in such architectural enclosures. Lighting should be used as a calculated structural material, he said. "Commercial architecture and commercial lighting have become inseparable," Mr. Muller-Munk said, "and we must help architects and engineers to learn to design with light." He further discussed the rut of sameness and monotony in present day lighting design, and reviewed some of the ways in which we can overcome this monotony.

Kenneth C. Welsh, architect and pioneer in shopping center development, was speaker on the fourth and last symposium of the second day session. He first presented some of the problems of urban renewal and suburban development, and showed the influence of modern day living on each, then showed how light can be integrated into the physical plans of these shopping centers for maximum benefit and use.

Three symposiums featured the third and final day of these meetings. One was on outdoor lighting for public areas, one on lighting for public buildings, and one on color and lighting.

Abe H. Feder, lighting con-

sultant, covered the subject of public recreational lighting and exploring the outdoors. He first described the concept of projected light, in terms of well-known and easily understood examples, then related this concept to various outdoor areas—roof garden for dining, public arcade for a community shopping center, outdoor stage, coliseum, parking areas, etc. In outdoor lighting projects, it is necessary to consider the reflection factor of the "ceiling" and "walls" as zero, he said. The techniques of equipment design, and the application of these designs to lighting projects, were discussed in some detail.

Milton Immerman, of Walter Dorwin Teague Associates, reviewed the scope of the work of an industrial designer and showed how this work fits into the field of lighting. He demonstrated a lighting product, a lens unit, which his firm had developed with "objectivity, inventiveness and practicability", after studying the problem and the need for the unit, to provide "high intensity, low brightness, and controlled illumination". He cautioned lighting equipment manufacturers to make available to engineers and designers specifications and light curves which are reliable.

Final symposium of the series was conducted by R. C. Allison, manager of new construction for T. Eaton & Co., Toronto, Canada, who discussed the "Use of Color and Lighting in Merchandising and Industry". He described light and color and how it fits into our way of living. Consumers buy most products—food, autos, for example—without ever seeing the products. Instead, they see the packages, out-

ARTHUR A. GORRELL, JR., left, associate engineer with Brittelle, Ginner, Decker and Associates, Carlsbad, New Mexico, here receives his award plaque for winning third place in the 1957 International Lighting Competition, for his outdoor lighting of the Stevens Motel. J. F. McPartland of Electrical Construction and Maintenance makes the presentation in Carlsbad.

PARTNERS IN PROFIT...

YOU AND GENUINE WAGNER MOTOR PARTS

When a Wagner Motor comes in for repair, team up your workmanship with Genuine Wagner Motor Parts. You'll get results that will build customer confidence and repeat business. What's more, you'll do a better job . . . faster and more profitably. That's because Genuine Wagner Motor Parts are exactly like the parts they replace. They fit right and they work right.

Make profits and friendly customers with Genuine Wagner Motor Parts—available through more than 850 Authorized Wagner Service Stations or Parts Distributors.

FOR WAGNER REPULSION-START INDUCTION MOTORS	FOR WAGNER CAPACITOR-START INDUCTION MOTORS
BEARINGS Wagner babbitt-lined sleeve bearings are diamond-bored to exact size—duplicates of the original bearings. Ball bearings—exactly the same as the original.	**BEARINGS** Steel-backed, babbitt-lined bearings have high load carrying capacity—won't seize—resist corrosion. They're easy to install with the **WAGNER BEARING TOOL**
BRUSHES The right size and grade for best motor performance.	**CAPACITORS** The capacitor number, stamped on the motor nameplate, is an easy guide to the right selection.
BRUSH HOLDERS Complete with brushes. Other parts of short-circuiting and brush lifting mechanism are also available.	**SWITCH ASSEMBLIES** Wagner quick-break switches are exceptionally efficient and trouble-free. But, if you do need a replacement, these are just like the original switches.
COMMUTATORS Built with extra strength for longer service life.	**SWITCH HUBS** Precision built to be exact duplicates of the originals.
ROTOR ASSEMBLIES Save rewinding costs—rotors are completely assembled, ready to install.	**GOVERNOR WEIGHTS AND SPRINGS** Designed to assure operation at the correct speed.

Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U. S. A.

MOTORS • BEARINGS • STANDARD ROTORS
BRUSHES • CAPACITORS • COMMUTATORS

WR58-3

OVER 850 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

ULTRA MODERN CITY HALL CALLS FOR UP-TO-DATE TRANSFORMERS

NEW CITY HALL, SAN JOSE, CALIFORNIA

HILL 1000 KVA Power Transformer was installed. Unit is a 3-phase, 60 cycle, oil filled, self-cooled, class OA, 55°C, 12,000V delta to 480Y/277V with taps.

Proven performance is the result of continuing research and development! HILL's engineers now, as in years past, continue to search out and test new ways to prove their product. Transformers must be "up-to-date" today, to stay in service tomorrow!

Manufactured to NEMA and ASA standards

OIL FILLED • ASKAREL DRY TYPES

HILL

HILL TRANSFORMER CO., INC.
1030 WASHINGTON STREET
SAN CARLOS • CALIFORNIA

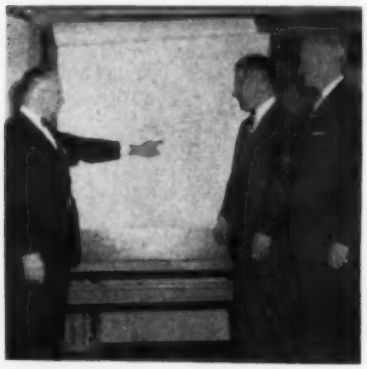
Available through leading electrical wholesalers

side finish and color. Women do not buy hats for their beauty, he said, but because it beautifies them. Thus the light within a store must be flattering to the packages, or, in the case of the woman buying the hat, it must flatter her. Process of seeing color is purely psychological, he pointed out, and a person "sees" what he "thinks" he sees—the whole scene rather than a series of dots in the retina of the eye. Color is to light and atmosphere as is taste to food, he said, and suggested that lighting engineers recognize these factors and take them into account in designing light for selling.

NWB Held Conference in Detroit

The 14th annual conference of the National Wiring Bureau held February 20 and 21 in Detroit, brought together nearly 300 wiring promotion executives and industry leaders for the annual report about what's going on and what's coming in the field of wiring promotion. The program included talks by electrical industry leaders, reports on various highly successful local promotions of residential and commercial wiring, a panel discussion of the Medallion Home program and presentation of the Fourth Annual "Look" Magazine awards, (see EC&M, March 1958, p. 217).

The keynote speaker, Frank S. Roby, vice president, Sales, of the Square D Co., and a vice president of NEMA, said, "These are electri-



ESTIMATING item is explained by Ray Ashley, electrical engineer of Chicago and authority on electrical estimating, to Robert F. Lange, Secretary, and John McSweeney, President, New York Association of Electrical Construction Engineers. Mr. Ashley spoke before the AECE group at their February meeting on the broad aspects of electrical estimating techniques and procedures.

fying years . . . residential power consumtpion has been climbing at the rate of double every ten years and the upward trend remains very strong." He cited figures from a survey conducted by the Chicago Metropolitan Home Builders Assn. showing that in 1950 the cost of wiring and fixtures in a $10,000 home cost only 2% of its selling price, the figures for 1956, 57 and 58 were 3.7%, 4% and 4.3% respectively. During the years 1941 to 1956, the number of wired homes increased only 75%, while sales of home appliances increased 450%. The great bulk of these appliances must be appearing on the poor overloaded wiring systems of the homes built prior to 1941. Peak heating-cooling loads of the future may well exceed the entire power of today.

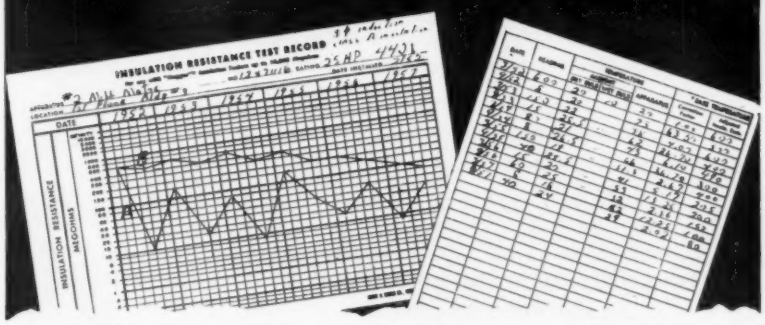
Luncheon speaker at the conference was E. O. George, vice president, Sales, Detroit Edison Co. Wiring, he pointed out, has been with us ever since electricity was first generated. But it had no glamour and so went unnoticed. The turning point came with the introduction of the electric range, the first generally accepted heavy-duty household appliance.

Milton Allen, vice president, Sales, Philadelphia Electric Co. and a member of NWB's Executive Committee, reported the results of a recent survey made by NWB to determine the extent to which electrical contractors are engaging in residential wiring modernization work.

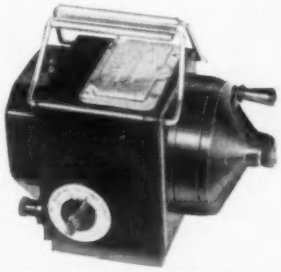
John Waitas, Bond Electric Service Co., Norwood, Ohio, described an electrical contractor's experiences with the Housepower program, operated through Cincinnati Gas & Electric's Wire-On-Time plan.

TRIO AIRING common problems at Minnesota Electrical Association meeting in Minneapolis includes (L to R): Fred Wiese, E. Wiese Electric Co., Lakefield, Minn.; Melvin Rixmann, South Side Electric Co., Minneapolis; and Emil Wiese, E. Wiese Electric Co., Lakefield.

"A STITCH IN TIME" SAVES DOWNTIME



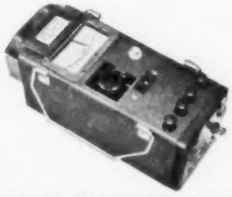
In other words, a "test in time" often avoids a costly machine outage, production loss and serious maintenance expense. The Test Record shown here is an example of how periodic measuring with a Megger® Insulation Resistance Tester gives you advance warning of impending trouble on an electric motor. This motor was repaired on a planned outage rather than under emergency conditions. Other dependable Biddle testing instruments are equally useful to detect trouble before it develops.



MEG® TYPE OF MEGGER INSULATION RESISTANCE TESTER— Available hand-operated, rectifier operated, or with a separate rectifier. Ranges up to 2000 megohms and 1000 volts d-c in all three models. BULLETIN 21-45-ECM

SPEED MEASURING INSTRUMENTS — Frahm®, Jagabi®, Dr. Horn, Metron, Jones Tachometers, Jagabi Speed Indicator and Jagabi Tachoscope. There's a Biddle tachometer to suit every maintenance need—to check speeds accurately for load, friction, power transmission and lubrication. BULLETIN 35-ECM

MEGGER GROUND TESTER measures the resistance of earth to ground connections simply, easily and accurately, and thereby helps to determine whether such connections will perform the services for which they were designed & installed. BULLETIN 25-ECM



MEGGER LOW RESISTANCE OHMMETER — Battery or rectifier operated. Four ranges 0-1000 microhms down to 0 to 1 ohm. New clamp type test leads 18 ft. long enable one man to make tests. BULLETIN 24-46-ECM

. . . serving your industry since 1895

B-805

JAMES G. BIDDLE CO.

Electrical Testing Instruments • Speed Measuring Instruments
Laboratory & Scientific Equipment
1316 ARCH STREET, PHILADELPHIA 7, PA.

PENNDRILL
MASONRY DRILLING EQUIPMENT

DRILL CONCRETE in SECONDS

Not Minutes Not Hours

The Penndrill Model "E" is a complete drilling unit, easily operated by one man and drills holes from 1 to 14 inches in diameter up to 19 inches deep.

Requires no set up time and presents no problems for drilling holes close to walls or in corners—one man can carry it up stairs.

Using diamond bits, it drills neat, clean holes vertically, horizontally or at any angle in concrete, asphalt, marble, granite, including any pipe, conduit, steel, etc. that might be encountered in the drilling.

PENNSYLVANIA DRILLING COMPANY
Masonry Drill Division
1021 Banksville Road, Pittsburgh 16, Pa.

Complete catalogue on request

Need OVERLOAD PROTECTION?

Here's what Pierce Renewable Fuses offer you:

- Positive protection to equipment
- Freedom from unnecessary blows
- Link replacement in a few seconds
- Far less maintenance and downtime
- Safety from dangerous afterblows
- Cooler operation — 6 to 8 times longer fuse life

We invite you to compare the unique construction of Pierce Fuses with any other good make — to check their strong tubular bridge that assures proper link contact and knife alignment — their screen vented design that prevents temperature buildup — their link replacement that requires only a screwdriver. For convenience, for peace of mind, for lower downtime and fuse costs, no fuse offers you so much as Pierce!

MAIL COUPON TODAY

PIERCE RENEWABLE FUSES, INC., Leicester, N. Y.

I would like to see and compare one of your Balanced Lag Pierce Fuses:

( ) Knife Blade Type ( ) Ferrule Type

Name.....
Company.....
Address.....
City.....State.....

NISA News

A talk on shop advertising methods has been added to the program of the Silver Jubilee Celebration, NISA's 25th anniversary convention which will be held May 11-14 in New Orleans. The speaker will be John Arthur of Arthur Advertising Agency of New Orleans, a past-president of the New Orleans Advertising Club.

• • • •

John F. Neihart was elected president of Quaker City (Philadelphia) Chapter of NISA at a meeting held March 19. Mr. Neihart, of Standard Electric, Reading, Pa. will be assisted by vice-president Al Albertson of Red Hill, Pa., treasurer Milt Eisenhardt of Pennsauken, N. J. and an executive committee composed of the following:

Howard W. Lee of Absecon, N. J.; Richard Lehr, H. N. Crowder Jr. Co., Allentown, Pa.; E. Paul Secreist, S&M Co, Trenton, N. J.; Clarence Chandler, McHugh Co., Wilmington, Del.; Paul J. Duphily of Electric Equipment & Maintenance Co., Milford, Del.; Stanley Lewars, Lebanon, Pa.; and George Wagner, Wagner Electric, Philadelphia.

• • • •

NISA national president Alfred Elson Jr., of New England Machine & Electric Co., Pawtucket, R. I. attended March meetings in Hartford, Conn.; Chicago; Bluefield, W. Va.; and Denver, Colo. and was chief speaker at each occasion.

• • • •

Another globe-trotter, NISA executive vice-president Joseph M. Harrington, organized new chapters in Utah and Montreal during March. Third new NISA chapter

AT NISA Northeastern Conference in Hartford, Conn. From left: Bob Sandman of Sandman Electric Co., Boston, Mass.; Jim Dipalo and George Wanner of Insulation & Wires' New Jersey branch; and Ed Lebowitz of Hartford Electric Machine Co., Hartford, Conn.

AT NISA Northeastern Conference in Hartford, Conn., from left: J. S. Krenkel of Belyea Co., Inc., Jersey City, N. J.; and Irving Hasnas and B. Milton of Empire Electric, Brooklyn, N. Y.

is the one in Columbus, Ohio. Total chapters to date: 38. On January 1, 1957 there were only 30. Nine new chapters have since organized, one of them replacing an existing chapter that covered a smaller area.

• • • •

Horace Barks, of Horace Barks Publications, St. Louis, the editor of *NISA News*, was elected president of the St. Louis professional chapter of Sigma Delta Chi, the national professional journalistic fraternity, at a meeting held on February 19.

• • • •

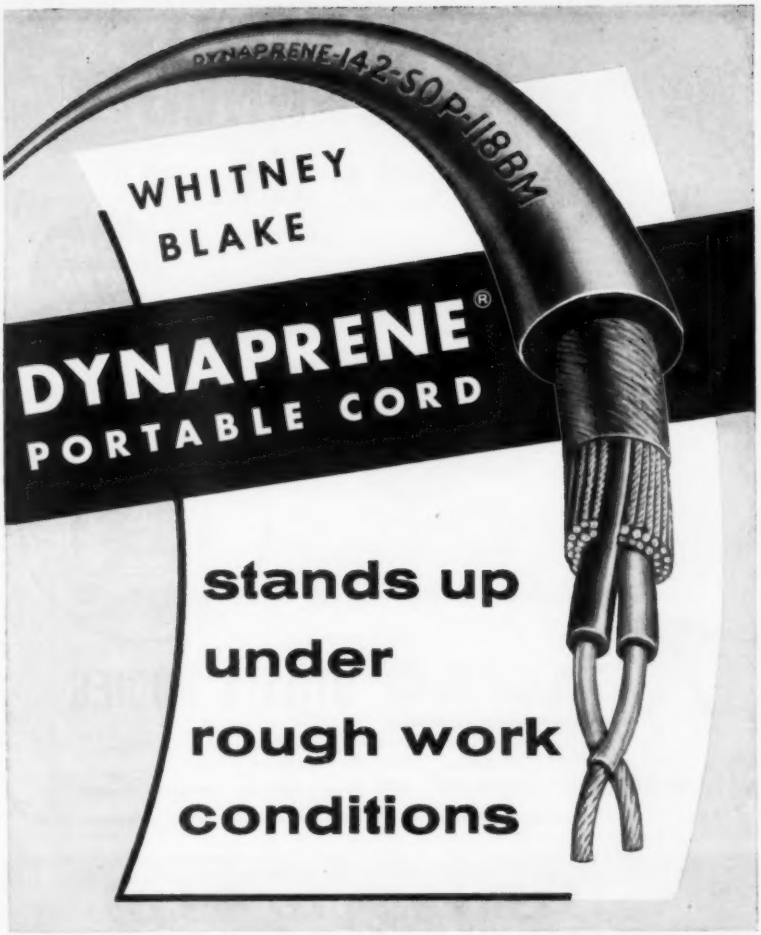
Robert R. Campbell of Krauth-Campbell Electric Co., Louisville, Ky., was elected president of Louisville Chapter at a meeting on March 11. Other officers include: vice-president, Dick McNalley of William C. Krauth Electric Co.; secretary, William Cecil, Owen Gollar Electric Co., and treasurer, Bernard Smith of Marine Electric Co., all Louisville shops.

• • • •

Item No. 1 on conventioneers' packing lists, says women's chairman Mrs. Margaret Johnson, should be a pair of comfortable shoes. Women guests will be going on walking tours of antique shops, restaurants and other fascinating places in the Vieux Carre during the Silver Jubilee Celebration, May 11-14, Mrs. Johnson notes.

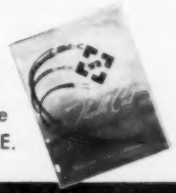
• • • •

State meetings of members of the Southeastern Chapter were held in Georgia at the Dempsey Hotel, Macon, on March 21; and in Florida at Hotel Dixie-Sherman, Panama City, on March 22. F. E. Cook of Electrical Equipment Co., Augusta, was chairman of the Georgia meeting, and Buford F. Ennis was in charge of the Florida conference.



Where portable cord takes a beating because of rugged work conditions, WHITNEY BLAKE DYNAPRENE stands up and gives long, economical service.

DYNAPRENE has an especially tough neoprene jacket, it resists abrasion, has high flexibility and long flex life, and provides premium quality service at competitive prices.



Write TODAY for this complete catalog . . . FREE.

WB

WELL BUILT WIRES SINCE 1899

WHITNEY BLAKE COMPANY

NEW HAVEN 14, CONNECTICUT

Get the **JOB-PLANNED** Body
designed as **YOU** need it!

Removable or permanent shelves and material trays

Removable, adjustable tray and shelf dividers

READING UTILITY BODIES

Compare all leading utility bodies—get
FREE Comparison Chart at your dealer or write:
READING BODY WORKS, INC., 420 Gregg Avenue, Reading, Penna.

SAVE 75% WITH TAL ALL-PURPOSE BENDER!

The Only One Shot Bender That Bends Without Changing Frames

- Pipe and Rigid Conduit
- Hard Copper and Steel Tubing (EMT)
- Radiant Heat Coils
- Bus-Bar—Flat and Round Bar Stock

The Only Bender
Available With or Without Remote Control and or Motor Pump

- Actual Savings 75% and more in direct costs of cutting, threading or welding, assembling, fitting and elbows.
- This MULTI-PURPOSE BENDER Will Handle *All* your requirements. Makes any bend or offset up to 180° *In Only One Setting.* Cold — Without Filling. Any size up to 8".
- WITHOUT Experience anyone can make perfect, identical bends . . . without guessing. Bend indicator and Bending Chart (Copyright 1956) furnished with each bender.

WRITE FOR FREE CATALOG

LEARN how you can slash material and assembly cost! Write today for a new illustrated catalog.

WRITE FOR FREE CATALOG

TAL BENDING EQUIPMENT, Inc.
DEPT. 21
MILWAUKEE 2, WIS.

AT NISA Northeastern Conference in Hartford, Conn., from left: Robert Bishop and Milton Bruner (right) of Electric Service Repair, Paterson, N. J. with Leo Brown (center) of Brownell Distributors, N. Y.

The Southeastern Chapter's annual technical forum for shop foremen was held in Charlotte, N. C., on April 4-5 at Hotel Selwyn. S. H. Browning of the Cleveland Electric Co., Birmingham, Ala. spoke on coil construction; John Kirkish of Louis Allis Co., talked about winding calculations. Other topics discussed were dc machines, carbon brushes, single-phase motors and NISA.

• • • •

Approximately 270 persons attended the Northeast Conference of NISA, sponsored by Connecticut, New England and New York chapters. The meeting was held in Hartford, Conn. on March 7-8 at the Hotel Bond.

Speakers included G. H. Bunnoe of General Electric who spoke on brush applications on slip ring and dc commutators; Carl L. Christiansen of Dow Corning Co., New York, who talked about Class H windings; Joseph Harrington, NISA executive vice-president, who reported on association activities; NISA national president Al Elson Jr. who urged members to resist recession pressures; John L. Pickens, research supervisor of Hartford Accident and Indemnity Co., who discussed "Loss Control—Management's Responsibility;" and *NISA News* editor Horace B. Barks, St. Louis, whose topic was "NISA Names Make News."

Prizes for shop ideas were judged by a committee headed by Alex Shovan, the national Ideas Contest chairman of NISA. $100 in prizes were distributed.

• • • •

A $25 hat (Texas style, probably) is being offered by former NISA president G. E. Jones of G. E. Jones Electric Co., Amarillo, Tex., to any-

one taking his bet that another state besides Texas ("no exceptions") will have the most registrations at the NISA Convention.

• • • •

Virginia shops met at Hotel John Marshall, Richmond, for dinner and a program that included talks by John W. Overton ("The Workings of NISA"); T. K. Preddy (plans for the Southeastern Chapter meeting at Old Point Comfort, Va. in October) and Tyree Thomas (pre-NISA days). Attendance was 24.

• • • •

New members of NISA include Caudill Electric Service of Los Angeles; Brown Electric Motor Service of North Hollywood, Calif.; Stump Electric of Los Angeles; and Industrial Motor Electric Co. of Woodland, Calif.

Other new members are Sweeney Electric Motor Service of Waterbury, Conn.; United Electric Motors of Atlanta; S. M. Electric Motor Shop of Dalton, Ga.; Gemmill Electric of Ida Grove, Iowa, and Chipman Electric of Brentwood, Md.

New members from Louisiana include Electrical Equipment Co. of Baton Rouge and Ouachita Electric Service of West Monroe.

New members of NISA from Michigan are Squier Electric Shop of Harbor Springs; Miller Electric, Grand Rapids; Weeks Electric Co., Grand Rapids; from New York is Post Road Electric Motor Co., New Rochelle; in Ohio, there are American Electric Motor Service of Columbus; Gettysburg Electric and Ohio Electric Equipment Corp. of Dayton; and Piqua Electric Motor Co. of Piqua.

B&H Electric of Chester, Pa. is a new member of NISA. So is Tracy Electric of Mitchell, S. D. and Bradley's Electric of Harlingen, Tex. In Canada, Willoughby Nantau Electric, Windsor, Ont.

AT NISA Northeastern Conference in Hartford, Conn., from left: Bob Cushing and Bob Judge of Huse-Liberty Mica Co., Boston, Mass.

BORTHIG
INSULATING VARNISHES...

For every need and application

There is a Borthig Insulating Varnish specifically made for every O.E.M. and Motor Service Shop need. And, as it is made by Borthig, you know it is the best.

BORTHIG BAKING VARNISHES

Number K-252 Clear Synthetic Baking Varnish (130° C.): A modern, general purpose baking varnish that has proved its worth over the years to both O.E.M. and Motor Service Shops.

Number 3829 Epoxy Baking Varnish (155° C.): A conventional type, clear, thermo-setting baking varnish that requires no activator.

MOLDING AND ENCAPSULATION COMPOUNDS

Number 3901 Epoxy Baking Varnish: A clear, quick baking varnish ideal for surface applications such as printed circuits.

Number 3900 Airdrying Epoxy Varnish: For use where baking facilities are not available or not necessary.

Number 911 Clear Epoxy Compound: Cures to a solid mass at room temperature by the addition of an activator.

Number 917 Epoxy Compound (gray): Cures with addition of activator. Good impact strength and thermal shock characteristics.

Number 1956 Thixotropic Paste: An Epoxy Paste with really tenacious adhesive qualities.

AIR DRYING AND FINISHING TYPE VARNISHES

Number 306 Black Synthetic Airdry and Number 356 Clear Synthetic Airdry: Where baking facilities are not available or for application to shallow coils where deep penetration is not essential.

Number 400 Red Insulating Varnish; Number 308 Black Insulating Varnish and Number 301 Black Oil Proof Varnish: Protective coating varnishes which can be applied over previously treated motor and transformer units as additional protection.

STATOR AND MASKING COMPOUNDS

Number 629-A Red Stator Compound: For application to stator windings for protection against abrasion and corrosion.

Number 613 Red Masking Compound: A special stripping compound to protect metal surfaces during the varnishing process.

There are other Borthig Insulating Varnishes and Compounds for special applications.

Solved Problems Are Another Product We Deliver.

GEORGE BORTHIG, INC.
Insulating Varnishes
EAST RUTHERFORD 6, NEW JERSEY • DRAWER 115

Fast tool repairs for Black & Decker tool owners

Genuine Black & Decker PARTS & SERVICE available near you

★ Free Inspection

★ Standard B&D Guarantee

Look Under "TOOLS-ELECTRIC" in Yellow Pages

Look in Yellow Pages under "Tools Electric" for address of nearest FACTORY SERVICE BRANCH

Or write direct for address of nearest branch to:

B&D Black & Decker®

QUALITY ELECTRIC TOOLS

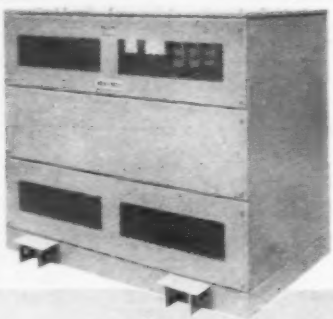
FREE! USE and CARE HANDBOOKS are available for each B&D Tool. Specify tools you own, write: THE BLACK & DECKER MFG. CO., Dept. 83104, Towson 4, Md.

another quiet

HEVI-DUTY

installation

225 KVA
480 — 208Y/120 Volts
Dry Type Transformer



PLACE: W. W. Samuell High School, Dallas, Texas
ARCHITECT: Office of Mark Lemmon, Dallas
ELECTRICAL CONTRACTOR: Gotham Electric Co., Dallas
ELECTRICAL CONSULTING ENGINEER: Zumwalt and Vinther, Dallas

HEVI-DUTY ELECTRIC COMPANY
HEAT PROCESSING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS
MILWAUKEE 1, WISCONSIN

Write for Bulletins 100 and 200 today.

DON BOWLING, vice-president of the Baer Electric Co., Moline, Ill., is caught by our camera at his drafting table reviewing plans and "specs" for one of the many jobs that Baer Electric has in progress.

Dallas County Group Elects Officers

J. H. Hill has been elected president of the Dallas County Group of the United Electrical Contractors Association.

Other officers elected were C. H. Krause, Krause Electric Co., vice president; and Morris DuVal, Hawes Electric Service, secretary-treasurer. Reelected to the Association's board of directors in addition to retiring president Myer Frauman, were T. E. D. Ferguson, A. W. Norwood and George W. Walker. Newly elected to the board were Henry W. Nelson, Clyde E. Grubbs and Austin L. Muukres.

MAINTENANCE ENGINEERS (left) Harry B. League from Sisters of Charity Hospital and College, Cincinnati, Ohio and (right) Frank Caveman from County of Hamilton, Cincinnati, Ohio were among Institutional representatives who attended an evening session of the Plant Maintenance Conference devoted to the "Upkeep of Electric Motors".

Program for NISA Convention To Be Held May 11-14

The 25th Jubilee Celebration of the National Industrial Service Assn. will be held at the Hotel Roosevelt, New Orleans, La., May 11-14. Advance registration indicates 1500 will attend.

Keynote speaker will be William M. Wallace, vice-president and general manager, general products division, industries group, Allis-Chalmers Manufacturing Co. His address will come after a welcome by New Orleans' mayor de Lesseps P. Morrison who will be introduced by the convention general chairman S. J. Stewart, president of the firm S. J. Stewart (Electric) of New Orleans.

Others who will address the convention are: H. L. Saumes, technical director of Anaconda Wire & Cable Co., Muskegon, Mich., who will discuss magnet wire developments; William T. McClelland, insulation engineer, Sterling Varnish Co., Sewickley, Pa., will report on varnish trends; and Dr. Graham Lee Moses, manager, engineering services department, Westinghouse Electric Co., Pittsburgh, Pa., will speak on "What's Ahead for Insulation."

William S. Giles, president, Giles Armature & Electric Works, Inc., Marion, Ill., will discuss "The Best Ways to Strip and Clean a Motor." Walter Brush of Electric Motor Service, Birmingham, Ala., will report on "How the NISA Standard Accounting System Has Helped Me to Learn My True Profit Picture." E. C. M. Johnson and Albert F. Whisenand of Scherer Electric, Indianapolis, Ind., will discuss shop

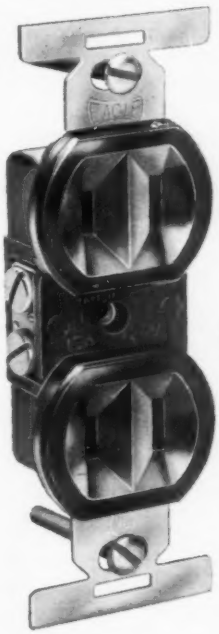
NISA EXHIBIT at the Plant Maintenance and Engineering Show held at the International Amphitheater was manned by W. L. Luebker of the Hyre Electric Co., Chicago, Ill.

NEW OUTSIDE-INSIDE

#977 #978 EAGLE DUPLEX RECEPTACLES

PERFECTION IS NOT AN ACCIDENT

WITH DOUBLE WIPE CONTACTS



ELIMINATE CALLBACKS
SAVING TIME AND MONEY

NEW MODERN DESIGN
NO GROOVES TO CATCH DUST

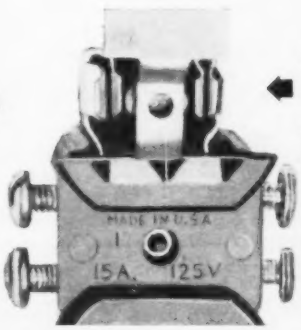
STURDIER BAKELITE BODY
FOR TODAY'S HEAVIER WIRING

CAT. NO. 978—WITH PLASTER EARS
CAT. NO. 977—WITHOUT PLASTER EARS

AVAILABLE IN BROWN OR IVORY
UNDERWRITERS LISTED
CSA APP. No. 6914

Eagle **PRESSURE** principle assures maximum contact area with prong

LARGER HEAD binding screws—backed and staked for quicker wiring—take to #10 wire



heavy duty DOUBLE WIPE contacts are Practically indestructible

SOLD THROUGH WHOLESALERS ONLY

SEND FOR FREE SAMPLE

EAGLE ELECTRIC MFG. CO., INC.
LONG ISLAND CITY 1, NEW YORK
"PERFECTION IS NOT AN ACCIDENT"

What is a FAIR PRICE?

*To be **FAIR**, both your customer and you must profit.*

Since 1926

NATIONAL PRICE SERVICE

suggests fair resale prices for electrical materials and tells you what they cost from day to day.

• • •

Keep current.

Be FAIR to yourself.

HENDERSON-HAZEL CORP. DEPT. A-84

13601 Euclid Avenue, Cleveland 12, Ohio

Please send complete details about NATIONAL PRICE SERVICE to us immediately - no obligation.

Name _____

Title _____

Company _____

Address _____

City _____ Zone____ State _____

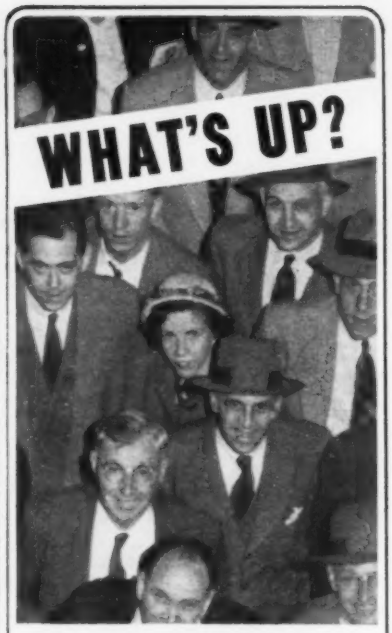
CONTRACTORS (left) George Glenning and (right) Harold P. Harris of the Spaulding Electric Co., Detroit, Michigan are shown reviewing program of one of the evening sessions of the Plant Maintenance Conference held recently in Chicago, Illinois.

layout and expansion.

James A. Phares of Southwest Electric Co., Oklahoma City, Okla. will discuss the importance of investment in equipment. A report on "What I Saw as a Newcomer to Shop Management" will be given by William M. Hankins, Jr., president of the Fred W. Kiemle Co., Toledo, Ohio, and who was recently named president of the Bunting Brass and Bronze Co. of the same city. A talk on "The Importance of Profits to Motor Shop Prestige" will be given by Carl L. Christiansen, electrical sales manager of Dow Corning Corp., New York City. Earle L. Rauber, vice president of Federal Reserve Bank of Atlanta, Ga., will report on economic conditions as they affect the electrical equipment service business.

Session chairmen have been selected from NISA past presidents, to represent the three decades of association history. Representing the 1930's will be William J. Wheeler, of the Maintenance Co., New York City, president of NISA, 1937-38, who will preside at the Monday morning meeting. On Tuesday, the session chairman, representing the 1940's will be Charles C. French, of French-Gerleman Electric Co., St. Louis, president of NISA in 1943-44. The Wednesday session chairman will be H. Edward Grant, Tennessee Electric Motor Service, Nashville, Tenn., representing the 1950's. Mr. Grant was NISA president in 1950-51.

Monday and Tuesday afternoons will be devoted to "shop talk" in the form of informal discussion groups, presided over by panels composed of speakers and other industry authorities.



way UP!!!?

SALES OF THE NEW INTERMATIC T-RATED SWITCHES

. . . GROWN BY LEAPS AND BOUNDS SINCE THEIR INTRODUCTION. **EVERYBODY'S** switching to the T-Rated Switch!

. . . "simple in design and engineered for long, trouble-free life;" . . . "built to give smooth running operation;" . . . "a time switch my customers can depend upon" — . . . and so they're saying — the men who KNOW and BUY time switches!

TUNGSTEN RATED TO CARRY INRUSH SURGES UP TO 8 TIMES THEIR NORMAL AMPERAGE RATING

TUNGSTEN RATED

Heavy duty Intermatics assure maximum reliability on the toughest jobs. Easy to install—easy to set—they save time, money, and trouble! It all adds up to the biggest PLUS in time switches today. Are you making the most of it? Write for the new 8-page color catalog Bulletin 48-Bt, illustrating and describing *63 Time Switch models!*

INTERNATIONAL REGISTER CO.
2624 W. Washington Blvd. - Chicago, Ill.

A program for women guests, expected to number nearly 500, will include walking tours through the French Quarter, a bus tour, lunches and fashion shows. Chairmen of the women's activities are Mrs. Margaret Johnson, Mrs. Leonce Bonnecaze and Mrs. Harry Mentrup.

Arkansas Chapter Elects Officers

Walter Stewart of Jonesboro has been elected president of the Arkansas Chapter of the National Electrical Contractors Association. Also elected were Delton Houston, Little Rock, vice president; E. M. Fagan 3rd, Little Rock, treasurer; and Floyd Sharp, Little Rock, Chapter governor.

NISA Directors Elected

Seven directors of the National Industrial Service Association were chosen in regional elections this month. They will serve three-year terms beginning in May.

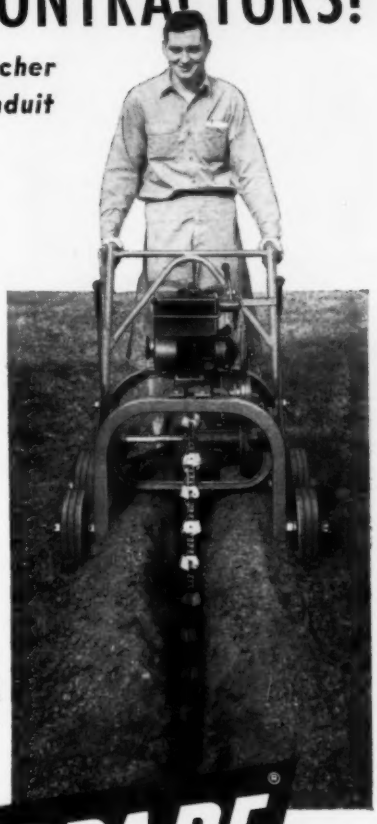
Elected were Edwin Kolhonen of Peabody Electric Motor Service, Peabody, Mass.; John G. Persson of Electric Apparatus & Repair Co., Philadelphia; John Graham Hammond of Hammond Electric Service, Inc., Rocky Mount, N. C.; Warren Mielke of Mielke Electric Works, Duluth, Minn.; Carl Lundberg of Cascade Machinery Co., Seattle, Wash.; Selden F. High of the Sullivan Electric Co., Cincinnati, Ohio; and G. E. Jones of G. E. Jones Electric Co., Amarillo, Texas.

Lundberg and High were re-elected to the NISA board. Jones, a former national past-president of NISA, returns to the board after a two-year absence.

The NISA board of directors consist of seventeen directors representing regions in the United States and Canada. The board directs the activities of the association which has more than 1,500 member firms that repair and rewind industrial electric motors, generators and transformers. The first meeting of the new board will be held during the association's convention in New Orleans, La., May 11-14.

ELECTRICAL CONTRACTORS!

Use this fast portable trencher for cable, pipe, tubing, conduit



POW-R-SPADE narrow trenches cost 1c to 5c per foot including labor.

•

Saves 80% - 90% cost and time compared to subcontract or hand digging.

•

Ready to go on the job, at once — no costly waiting around.

•

Can pay for itself in one day's operation.

POW-R-SPADE digs a neat 3" wide trench. Dirt is delivered well pulverized on each side of trench — no lumps or clods. Easy to back fill.

STAMPINGS

POW-R-SPADE®

MADE BY STAMPINGS, INC. Davenport, Ia.

Portable from job to job. Easily handled by one man.

APPROVED and recommended by hundreds of users in every area of the United States.

Get more facts about the earning power of POW-R-SPADE.

WE ADMIT that these are strong statements. And yet, POW-R-SPADE users confirm them again and again. For here is a machine that is ideal for trenching 3" wide to 24" deep, where larger machines are costly and impractical; where hand labor is slow and expensive. No heavy wheel marks or unnecessarily wide trench to scar lawns. Digs right up to foundation of building. Goes 1½ to 17 feet per minute, depending upon soil conditions.

A rugged machine. Easy to set and to operate. Oil-sealed bearings. Powered by a well-known engine. Minimum maintenance. Shipped completely assembled, ready to go to work for you. Additional interesting details and information immediately yours upon return of the coupon.

Stampings, Inc., 1017½ Mound St., Davenport, Iowa

Please send material on POW-R-SPADE to:

Name .....

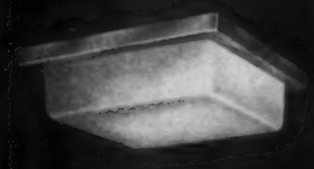
Company .....

Street .....

City .....State .....

lighting
design
by
mcPhilben

32-88



UL-approved for two 100 watt lamps

Cast Aluminum Quality

mcPhilben's 32-88 square ceiling unit is UL-approved for two 100 watt lamps. Its clean, modern lines, combined with maintenance-free operation, make it the ideal choice for institutions and industry: corridors, lobbies and lavatories.

The 32-88's face plate is of solid cast aluminum with a gleaming satin finish. Corrosion resisting construction features a reinforced and insulated back plate of zinc-clad bonderized steel. The cast carrara glass bowl swings to one side for easy cleaning. Available with mcPhilben's exclusive one-piece cast aluminum hinged guard. Also in vaportight 43-88 series.

Ask your nearby mcPhilben representative for full details. See our insert in Sweet's file 32a/mc or write for data sheet.

mc Philben
LIGHTING COMPANY
1329 Willoughby Avenue
Brooklyn 37, New York

N. J. MacDonald Elected Chairman of N.E.W. Committee

N. J. MacDonald, president of The Thomas & Betts Co., Elizabeth, N. J., was elected chairman of the National Electrical Week Committee at the committee's semi-annual meeting in Chicago last month.

He succeeds Merrill E. Skinner, vice president and director of sales of Union Electric Co., St. Louis, who has led the development of National Electrical Week as an all-industry event for the past three years.

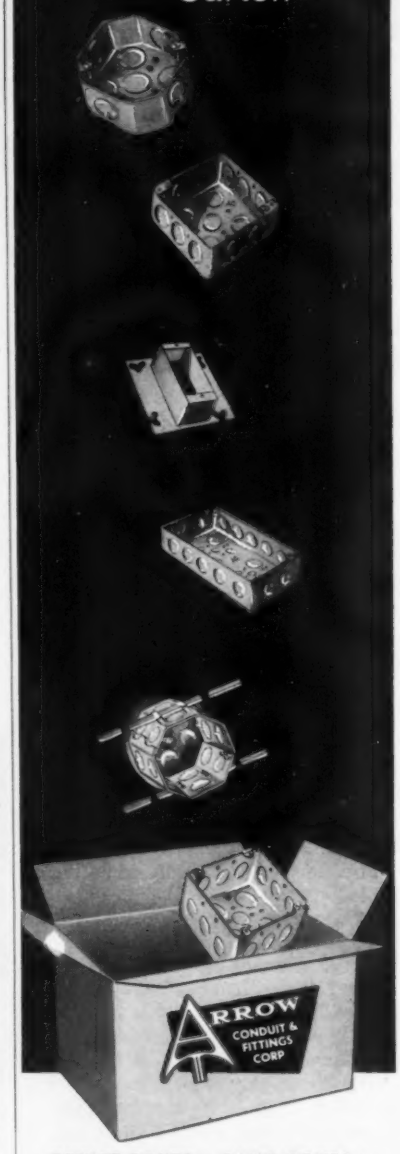
The committee reviewed reports on the 1958 observance of N.E.W., elected officers, and approved preliminary plans for the next annual observance, scheduled for February 8-14, 1959.

Mr. MacDonald said he regarded National Electrical Week as an outstanding opportunity for all segments of the electrical industry—power suppliers, manufacturers, distributors, contractors, dealers, inspectors, wiremen, and electrical leagues—to further their basic educational and electrical promotion programs.

"We plan a strong observance for 1959," he said, "one which will focus a spotlight throughout the nation on the electrical industry and its contributions to progress."

Other N.E.W. committee officers elected include Col. S. R. Todd, past president of International Association of Electrical Inspectors, as vice chairman; Arthur W. Hooper, executive director of the National Association of Electrical Distributors, as secretary, and Harold A. Webster, president of T. Frederick Jackson, Inc., of New York City, as treasurer.

Only
QUALITY
Goes Into This Carton –



OUTLET BOXES • GANG BOXES •
COVERS • BOX SUPPORTS

ARROW CONDUIT
& FITTINGS CORP.
129 30th STREET, BROOKLYN 32, N. Y.
Sales Representatives & Warehouse Stocks*
BALTIMORE, MD. • CHARLOTTE, N.C. • *CHICAGO, ILL. • *CINCINNATI, OHIO • *DENVER, COLO. • DALLAS, TEX. • *LOS ANGELES, CALIF. • *MIAMI, FLA. • NEW YORK, N. Y. • NEWTON CENTRE, MASS. • *PHILADELPHIA, PA. • ROCHESTER, N.Y.

CONSULTING ENGINEER E. D. Wilder, Jr., from Ashland, Mass. (left) and electrical contractor John M. Blomgren of the Eastern Elec. Co. in Cochituate, same state (right) flank the owner-representative of Romeo's Supermarket, Ashland, Mass., where their joint-effort lighting installation merited twin third-prize plaques in the 1957 International Lighting Competition.

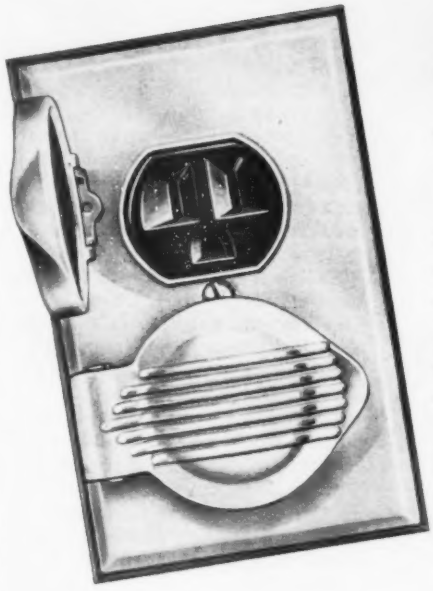
California Proposes 5-Year Apprenticeship Program

In California, a move to add a fifth year to an electrician's apprenticeship—a year devoted to electronics—received the blessing (Feb. 14) of the state organization of the International Brotherhood of Electrical Workers.

The labor group—called the California State Association of Electrical Workers—recommended that the fifth year be added. The reason: increasing use of automation in industry makes it necessary for a qualified electrician to know how to install electronic controls and other

MAINTENANCE FOREMAN W. D. Shaw of the Saginaw Steering Gear Co., Div. of GMC, Saginaw, Michigan is caught by our camera as he leaves an interesting session of the Plant Maintenance Conference devoted to the "Upkeep of Electric Motors".

FLIP TITE



ROYAL ELECTRIC

WEATHERPROOF DEVICES and UNIVERSAL COVER PLATES

Where performance and appearance count, it pays to install Royal "Flip-Tite" weatherproof devices. Individual spring-hinged cover with heavy sponge rubber pad, seals each outlet separately.

"Flip-Tite" is available in styles for most applications, with receptacles and switches; or as Universal Cover Plates, single and duplex, for weatherproofing existing outlets. Order from your wholesaler today . . . or write Royal for Bulletin 2-03-7, giving wholesaler's name.

- Spring-hinged "FLIP" covers, with cadmium-plated springs and sponge rubber weather seals
- Covers open more than 90°; quick and easy to use in daylight or dark
- No loose, dangling covers; no turning to take off or replace
- Non-corroding plates and covers ensure long, dependable service
- Sealed-tight construction; spring-hinged pressure keeps rubber seal tight when closed

MADE RIGHT

TO BE RIGHT . . . on the job!

ROYAL ELECTRIC AN ASSOCIATE OF IT&T

ROYAL ELECTRIC CORPORATION
an associate of International Telephone and Telegraph Corporation
PAWTUCKET • RHODE ISLAND

Now-do
MASONRY DRILLING
TWICE AS FAST*

...on Wiring Installations, Plant Maintenance Work

USE YOUR OWN HD ¼" ELECTRIC DRILL and

NEW, LOW-COST IDEAL

ROTARY IMPACT DRILL ATTACHMENT

It saves you money as it saves you work. Converts any heavy duty, ¼" electric drill into a HIGH SPEED MASONRY IMPACT DRILL — at a fraction the cost of a heavy impact tool.

• NO HEAVY PRESSURE NEEDED!

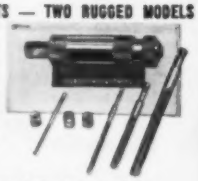
It bites as it twists. Precision inner cam action delivers a lightning-fast, hammer-like blow with each half revolution . . . drills clean holes quicker and with far less effort into brick, concrete, dense aggregate, tile, etc. Bits last longer, because there's no bind or drag.

New, Positive-Grip "ROTO-LOCK" CHUCK

No wrenches or set screws. Turn the knurled collar and a cam locks the bit in a solid, vibration-proof grip that assures straight, true holes.

COMPLETE LOW PRICE KITS — TWO RUGGED MODELS

For *frequent* or *occasional* drilling, with semi-permanent or instant connection to your drill. Complete kits include attachment and most-used bit sizes. Or order individual attachments with your choice of IDEAL bits, FROM 3/16" to 1".



*By actual job tests, compared to drilling with carbide tipped bits.

SEE YOUR IDEAL DISTRIBUTOR OR MAIL COUPON
Sold through America's Leading Distributors
In Canada: Irving Smith, Ltd., Montreal

IDEAL INDUSTRIES, Inc.
1041-D Park Avenue, Sycamore, Illinois
Please send latest catalog data on IDEAL Rotary Impact Drill Attachments.

Name_____
Company_____
Address_____
City_____ Zone____ State_____

type of electronic equipment.

Said an IBEW spokesman in the San Francisco Bay Area: "Our electronics work has increased 20% in the past three years."

And industry sources foresee more electronics work in commercial and residential installations, as well as industrial jobs.

California apprenticeship people say there seems to be agreement that electronics training is needed, but there's a difference of opinion on whether a fifth year of traning is necessary. Some people suggest tossing out certain portions of the present training program and substituting electronics, thereby squeezing the whole program into four years.

One proposal is to make the fifth year optional. A man would then become a journeyman inside wireman in four years, an inside wireman and electronic technician in five years.

Details of the program are still to be worked out. Next step: decision by the joint statewide electrical construction industry apprenticeship committee on new apprenticeship standards.

Local joint apprenticeship committees would not be bound by the state group's decision, but they usually go along with it. It would be up to local collective bargaining to decide whether an inside wireman would have to serve a five-year apprenticeship.

If the five-year program is adopted by the State committee it may be incorporated in some labor contracts due for renewal in June of this year.

1957 INTERNATIONAL LIGHTING CONTEST winner in the Engineer-Architect division is Melvin Cohen (right), A. Epstein & Sons, Inc. Mr. Cohen is being congratulated by Middle West Editor August Eckel (left), E. C. & M. who made the presentation.

YOU PROFIT

by selling NEW Big Beam AUTOMATIC EMERGENCY LIGHTS with Glass Jar Batteries

Heavy-duty, long-lived glass jar batteries come in 30, 40, 80, and 100 amp.-hr. sizes. Built-in trickle charger and fast charger has 12-hour automatic timer.

It's the most COMPLETELY DEPENDABLE emergency light ever built. When regular lights fail . . . this new Big Beam turns on instantly . . . provides many hours of illumination.

NEW Big Beam EXPLOSION-PROOF HAND LAMP

Approved by Underwriters' Laboratories for use in hazardous locations, Class I, Group D. Designed to meet popular demand for a SAFE lamp with Big Beam's quality features. 6368

Write for Literature Today

U-C-LITE Manufacturing Co.
1035 West Hubbard Street, Chicago 22, Illinois
In Canada: Bernard Marks & Co., Ltd., 70 Claremont Street, Toronto 3, Ontario

DON'T RISK THIS

INSIST ON RUGGED LOUISVILLE LADDERS

Don't take chances with "price" ladders. Step up with confidence on UL-approved *Louisville* aluminum ladders, planks and stages — *the equipment with safety built-in!* Check the yellow pages for nearest distributor, or write us direct.

BUILT-IN SAFETY

Exclusive *Louisville* "boss" rung-to-rail assembly insures against ladder sway and rung turning and loosening. Ask your *Louisville* distributor to demonstrate.

Round Peg in "Hex" Hole Riveted to Rung.

LOUISVILLE LADDER COMPANY
1101 West Oak Louisville, Kentucky

CHICAGO CONTRACTORS receive awards for their entries in the 1957 International Lighting Contest. August Eckel (left), Middle West Editor, Electrical Construction and Maintenance is shown presenting plaques to Sidney Rosset (middle), Marsh Electric Co., and J. J. Compernolle (right), Kelso-Burnett Electric Co. Mr. Rosset's lighting entry was a co-venture with B. H. Stein, Chicago architect.

D&B Polls Business Outlook

Somewhat less optimism was found by Dun & Bradstreet, Inc. in its latest compilation of businessmen's opinions than in other such quarterly queries of the last two years. But the majority expected business in their own companies in the second quarter of 1958 to equal or exceed that of the like period last year.

Lagging industrial production, cuts in capital spending, and higher unemployment during recent months have perhaps contributed much to somewhat lowering the spirits of many businessmen. A year ago only 5% expected that their sales would be down in the second quarter of 1957, while now almost one quarter anticipate a year-to-year decline in the second quarter of this year. About one half of all those interviewed foresaw no change in profits. This compares favorably with the opinions expressed by businessmen as to the second half of 1949, like the second quarter of 1958, a period that followed several months of lagging business activity.

The majority expected no change in their selling prices, and those anticipating increases in the second quarter of 1958 were far less numerous than those of the same opinion in a similar survey a year ago.

Pictured (left to right) Alfred Scheer, Shaw, Metz & Dolio electrical engineer; George Nejdl, asst. electrical engineer for Shaw, Metz & Dolio; P. R. Ellingson, plant engineer, Johnson Motors; R. S. Terhune, Nelson sales representative.

NELSON

helps make your Johnson outboard motors

Seven Nelson unit substations similar to the one pictured above were used in the new Johnson Motors die cast expansion at Waukegan, Illinois. Each unit, compactly designed for ease of operation and maintenance, controls the flow of power to a section of the plant.

The unit shown is substation No. 3. This is a 1,000 KVA unit, rated 12,000 volt delta primary to 480 volt Wye 277 volt secondary, and incorporating Nelson Class 722 low voltage switchgear. This gear includes 1 — 50,000 AIC main and 8 — 25,000 AIC feeder breakers, and has fully equipped spaces for five additional future feeder breakers.

Thanks to the close cooperation on the part of Shaw, Metz & Dolio, architects and engineers of Chicago, the engineer at Johnson Motors, and the contractor, Aldridge Electric Company with Nelson Electric Manufacturing Company, this installation was made to the *complete satisfaction* of all parties.

When you need any type of electrical control equipment, consult NELSON. The type of team work that made the Johnson Motors installation possible can help you streamline your plant for more efficient operation.

To learn more about Nelson Electric Manufacturing Company please write for pictorial index and brochure describing our new plant.

a major source of electrical control equipment for industry

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

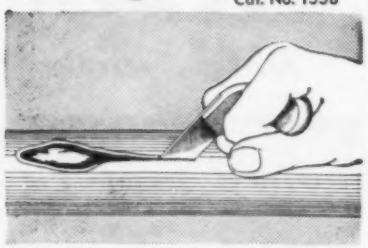
NEW KLEIN

stripping tool

for all types of control cable

Patents 2398979
2691822

Cat. No. 1558



Here is a new tool developed by Klein, designed to strip insulation from all types of control cable, flexible cords, PWC, telephone cable with vinyl or polyethylene jackets and bus drop.

Handle of cast aluminum, light in weight and with convenient grip; knife of tempered tool steel may be sharpened and is easily removed for replacement. This tool strips insulation from a few inches to as many feet as desired swiftly and simply. Does not damage conductors inside weatherproof sheath.

Write for bulletin giving complete information.

FREE POCKET TOOL GUIDE

100 years of service to linemen, electricians and industry is back of this new Pocket Tool Guide No. 100. A copy will be sent you on request without obligation.

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard
Electric Corp.
New York

Mathias KLEIN & Sons
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

DATES AHEAD

International Association of Electrical Inspectors—Alabama Chapter, Hotel Stafford, Tuscaloosa, Ala., April 17-18; **Tennessee Chapter,** Andrew Jackson Hotel, Nashville, Tenn., April 21-22; **Five Chapter Joint Meeting,** Angelina Hotel, Lufkin, Texas-Baton Rouge, George Welman, North Louisiana-East Texas, Texas and Texas Gulf Coast Chapters—May 2-3; **Florida Chapter,** Cherry Plaza Hotel, Orlando, Fla., May 8-10; **Virginia Chapter,** Ingleside Inn, Staunton, Va., May 12-13; **Western Section,** Sheraton-Cadillac Hotel, Detroit, Mich., September 7-10; **Northwestern Section,** Billings, Mont., Sept. 15-17; **Southwestern Section,** Southern California, September 22-24; **Canadian Section,** Montreal, Quebec, Canada, October 10-11; **Eastern Section,** October 13-15; **Southern Section,** Miami, Fla., October 20-22.

Illuminating Engineering Society — Northeastern Conference Statler Hotel, Hartford, Conn., April 10-11; **East Central** Conference, John Marshall Hotel, Richmond, Va., April 14-15; **South Central-Southeastern** Conference, Lafayette Hotel, Little Rock, Ark., April 24-25; **Southwestern** Conference, Washington Youree Hotel, Shreveport, La., April 28-29; **Mid western** Conference, Hotel President, Kansas City, Mo., May 1-2; **Inter-Mountain** Conference, Whitman Hotel, Pueblo, Colo., May 8-9; **South Pacific** Conference, El Cortez Hotel San Diego, Calif., May 12-13; **Pacific Northwest** Conference, Multnomah Hotel, Portland, Ore., May 22-24; and **Great Lakes** Conference, Sheraton Hotel, Rochester, N. Y., June 23-24.

Rocky Mountain Electrical League—Annual convention, Shirley Savoy Hotel, Denver, Colo., April 13-20.

National Association of Lighting Maintenance Contractors—Annual meeting, Hotel Statler, Cleveland, Ohio, April 28-30.

National Industrial Service Assn.—25th "Jubilee Celebration," Hotel Roosevelt, New Orleans, La., May 11-14.

National Fire Protection Assn.—Annual meeting, Palmer House, Chicago, Ill., May 19-23.

National Association of Electrical Distributors—50th annual convention, Civic Auditorium, San Francisco, Calif., June 9-13.

Edison Electric Institute — Annual convention, Convention Hall, Boston, Mass., June 9-12.

New York State Assn. of Electrical Contractors & Dealers, Inc.—Annual convention, Whiteface Inn, Lake Placid, N. Y., June 29-July 4.

Illuminating Engineering Society — National Technical Conference, Toronto, Canada, August 17-22.

International Association of Electrical Leagues—Annual Conference, Washington, D. C., October 1-3.

National Electrical Manufacturers Assn. — Annual conference, Hotel Traymore, Atlantic City, N. J., November 10-14.

National Electronics Conference, Inc.—Hotel Sherman, Chicago, Ill., October 13-15.

National Electrical Contractors Assn., —Annual convention and National Electrical Exposition, Adolphus Hotel, Dallas, Texas, November 16-21.

Among the Manufacturers

Headquarters Announcements

Eagle Electric Mfg. Co., Inc., Long Island City, N. Y., has purchased the entire assets of the Matol Corp., Tilton, N. H., for the manufacture of metal socket shells and caps.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—William H. Davis, manager of product sales, electrical department, Norwood, Ohio, Works; Paul S. Castner, manager of sales, Pittsburgh Works; Frank M. Nolan, manager of sales, switchgear department.

Robertshaw-Fulton Controls Co., New York—Albert D. Unetic, general manager, Acro Division; H. F. Jacobsmeyer, sales manager, Grayson Controls Division.

General Electric Co., Danville, Ill.—Eugene C. Pauly, manager, indoor sales, Ballast Department.

Anderson Electric Corp., Birmingham, Ala.—John H. Schuler, vice president in charge of operations.

Burndy Corp., Norwalk, Conn.—Herbert Grossman, assistant sales manager, commercial activities; Richard Harap, assistant sales manager, product activities; both with Utility-Industrial Division.

General Electric Co., Bloomington, Ill.—Robert B. Kurtz, manager of manufacturing, General Purpose Control Dept.

Westinghouse Electric Corp., Pittsburgh, Pa. — Howard J. Thomas, manager, wholesale and utility sales, Lamp Division.

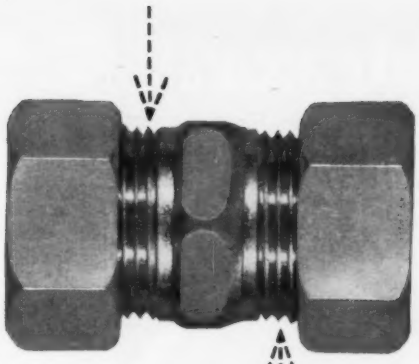
Electric Auto-Lite Co., Toledo, Ohio—Robert A. Barker, manager of engineering; Fred Wetzel, engineering consultant; both with Wire and Cable Division.

H. K. Porter Co., Inc., New York—Burton Schellenbach, vice president, sales, headquarters in Pittsburgh offices.

Benjamin Electric Mfg. Co., Des Plaines, Ill.—R. J. Mors, general sales manager.

Lighting Products, Inc., Highland Park, Ill.—H. A. Glass, executive vice president; E. H. Church, vice president, sales and operations; E. F. Kiehl, sales service manager.

Arrow-Hart & Hegeman Electric Co., Hartford, Conn.—Frank L. Mathes, vice president; Leslie A. Goodwin, sales manager of distributor sales, Wiring Device Division; Howard J. Varley, sales



Full perfect threads

work faster and easier

BLACKHAWK EMT FITTINGS have full, true, perfect threads for ease and speed of installation. Bodies of heavy steel — cadmium and zinc finished to eliminate corrosion on the unit itself. Blackhawk's new EMT fittings are rain tight. Quality controlled at every phase of the manufacturing. In demand for electrical jobs large and small because they're easy to use.

Blackhawk's new EMT fittings are a product of continuing Blackhawk research and automated methods of manufacture. Order a stock today to meet the demand for these quality made, EMT fittings. A complete range of sizes is now available.

Blackhawk Industries, Dubuque, Iowa

Where the new ideas come from

DUST-TIGHT
LIGHTING FIXTURES

. . . for Hazardous Locations where flammable or explosive dusts exist. Class II, Groups E, F, G and Class III.

With 2 Exclusive Design Features

R & S Type DL Lighting Fixtures embody outstanding advances in fixture construction and installation simplicity! They operate far below allowable temperatures for this type of installation.
Two exclusive design features, in addition to basic advantages common to other well-constructed dust-tight fixtures, assure faster and easier installation and relamping. Cast aluminum alloy—shaped with streamlined surfaces to prevent dangerous accumulation of dust particles.

Write For Catalog No. 56-4

Pendent and Junction Box bases standard to all fixtures. Accommodate any fixture-glove-reflector assembly in either 100 or 200 watt sizes.

RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N. Y. FIA

RUSSELL & STOLL

PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1902

Make accurate Repeat bends Easily!

EXCLUSIVE CALIBRATED DEGREE SCALE ELIMINATES GUESSWORK

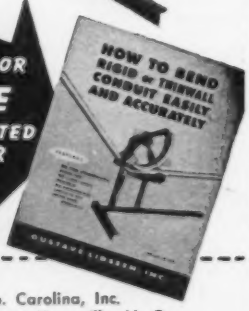
SMOOTH UNIFORM BENDS
Repeat bends, as well as smooth offset and 180° bends, are easy and fast to make. When using a "Chicago" pipe bender you always turn out professional work quickly without any special skill. The accurate bending sector does the work and supports the full length of bend.

RUGGED . . . PORTABLE
An occasional drop of oil on the powerful toggle-ratchet mechanism is the only maintenance required. There are no loose parts to be misplaced or lost. Its light weight, 66 lbs.*, makes it a real on-the-job tool . . . always at a comfortable working height.

*No. 1—66 lbs.
No. 2—89 lbs.

Illustrated . . .
No. 2 for bending
1" to 1½" conduit

WRITE FOR FREE ILLUSTRATED FOLDER



Send for
Lidseen of No. Carolina, Inc.
1050 First Street, Hayesville, N. C.

NAME_____
COMPANY_____
ADDRESS_____
CITY_____

manager, Appliance Switch Division.

Simplex Wire and Cable Co., Cambridge, Mass.—John M. Murray, sales manager.

Kuhlman Electric Co., Birmingham, Mich.—Perry M. Green, Jr., general sales manager, Transformer Division.

Diamond Wire & Cable Co., Sycamore, Ill.—Harry H. Kellogg, assistant sales manager.

Kaiser Aluminum & Chemical Corp., Chicago, Ill.—J. C. Ferguson, product manager; R. J. Harrison, assistant product manager; H. F. Johnson, administrative manager; all with Electrical Conductor Division.

Chester Cable Corp., Chester, N. Y.—Richard Kerney, general production manager.

Westinghouse Electric Corp., Pittsburgh, Pa.—C. H. Bartlett, executive assistant to A. C. Monteith, vice president and general manager of apparatus products group; H. R. Larson, manager of manufacturing and repair (M&R) divisions.

Line Material Industries, Milwaukee, Wis.—Lloyd L. Black, vice president, manufacturing; Warren R. Higgins, acting manager of Zanesville plant.

Ridge Tool Co., Elyria, Ohio—Carl H. Ingwer, chairman of the board; Joseph A. Frates, president and general manager.

Penn-Union Electric Corp., Erie, Pa.—Clinton G. Gerlach, president and director.

Smithcraft Lighting, Chelsea, Mass.—George T. Wood, manager of lighting sales.

National Electric Products Corp., Pittsburgh, Pa.—C. E. Russell, steel division plant manager, Ambridge, Pa., plant.

William Brand & Co., Inc., Willimantic, Conn.—Charles R. Riordan, assistant general manager.

Federal Pacific Electric Co., Newark, N. J.—Frank S. Nelson, manager of Scranton plant; Bernard G. Tremblay, assistant plant manager of Newark manufacturing operation.

International Resistance Co., Philadelphia, Pa.—Dr. Alfred H. Williams, member of the board of directors.

Baldor Electric Co., St. Louis, Mo.—A. H. Barrere, Jr., assistant sales manager.

Regional Appointments

MIDDLE ATLANTIC

Federal Pacific Electric Co.: C. G. Landeck, distributor products sales manager; George A.

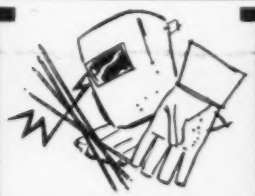
Sound Powered Telephones

need no batteries

Never fail in any emergency because they operate without current of any kind over a distance of many miles. Can be moved with the job as construction progresses or serve permanently where power failures may occur. In outdoor and indoor models.

Write for illustrated catalog

HOSE-McCANN TELEPHONE CO., INC.
761 THIRD AVENUE, BROOKLYN 32, N. Y.



Protect Your Welding Generator with

HELWIG CARBON BRUSHES

Get maximum generator efficiency . . . protect electrical equipment with HELWIG BRUSHES that offer better commutation, longer brush life. Equal in quality and specs as original equipment. Stock available for immediate delivery — anywhere. Depend on HELWIG for speedy "RED CARPET" Service. *Write for new catalog No. 87.*

AVAILABLE NOW "RED CARPET" RUSH BRUSH SERVICE.

HELWIG CO.
CARBON PRODUCTS
2546 N. 30th ST.
MILWAUKEE 10, WIS.
HELWIG SPEER

Bury, product manager for switch and fusible equipment; F. C. Karlson, Baltimore district manager; Arthur Wolfe, representative in Harrisburg, Pa.; Richard Oxley, representative in Scranton; all with Middle Atlantic Region.

Electro Silv-A-King Corp.: Marvin Laxer, district manager of northern New Jersey.

Delta-Star Electric Div., H. K. Porter Co., Inc., Ralph M. Bozarth, head of new Philadelphia office.

Auth Electric Co., Inc.: John C. Fox & Son and Herbert C. Zang, representatives for New York State.

Minnesota Mining & Manufacturing Co.: Gale R. Billard, Philadelphia branch sales manager for electrical products.

Lima Electric Motor Co., Inc.: Jack B. Hicks, district manager in charge of new office in New York.

Garcy Lighting: R. Paul Talbot, factory representative, headquarters in Minneapolis.

Smithcraft Lighting Division: Edward J. Furey, sales representative in New York City area.

SOUTH ATLANTIC

Auth Electric Co., Inc.: H. C. Biglin Co., representatives for North and South Carolina, Georgia, Florida, Mississippi, Alabama, Louisiana and Tennessee.

Delta-Star Electric Div., H. K. Porter Co.: Herbert O. Arnold, branch manager of new office in Roanoke, Va.; Norman E. Shipley, branch manager of new office in Baltimore, Md.

Walker Brothers: Clarke & Lype Associates, representatives in Western Pennsylvania and West Virginia.

J. A. Wilson Lighting and Display Inc.: Hawn & Stear, Inc., representatives in Western Pennsylvania and West Virginia.

Spang-Chalfant Div., National Supply Co.: Lance Call Co., Falls Church, Va., conduit representative in Washington, D. C., area.

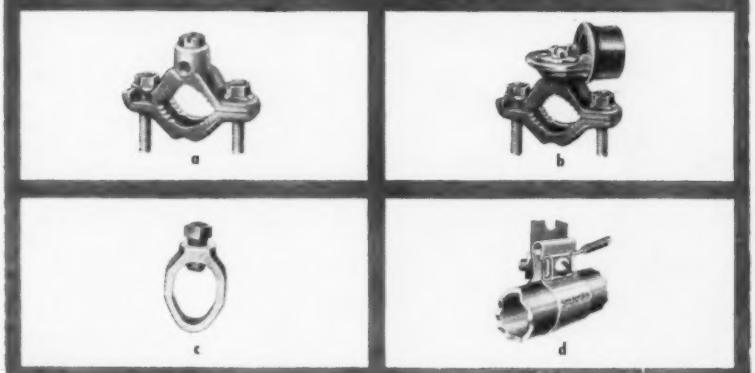
A. H. Massey, Inc.: Bill Crichton, sales representative in Florida, office in Riverview, Fla.

Kaiser Aluminum & Chemical Sales, Inc.: R. A. McDuffie, electrical conductor sales supervisor in Atlanta, Ga., district.

EAST CENTRAL

Walker Brothers: Glen P. Stearns Co., Columbus, Ohio, representatives for underfloor systems in Ohio; representatives for wire, cable and EMT in Ohio, Kentucky and Indiana.

to be well grounded—



rely on **Sherman**

a. GF-138 Solderless Ground Fittings—Rugged bronze for strong, permanent grounding. For ½-1", 1¼-1½", 1½-2" pipe.

b. GF-23 Conduit Solderless. Adjustable swivel hub. Strong bronze alloy. For ½" to 1" dia. pipe.

c. Cast Clamps meet REA and utility standards. Low-resistance copper alloy. Wedged connection won't loosen.

d. SL Type. UL approved. Tempered pure copper. Wire up to AWG #8 solid. Positive and permanent.

H. B. SHERMAN MANUFACTURING CO.
Battle Creek, Michigan

Selection and Specification Data

Write for Bulletin 158

THE Adalet MANUFACTURING COMPANY
14300 LORAIN AVENUE • CLEVELAND 11, OHIO

MODERNIZE
YOUR
STOCK ROOM
LIGHTING

MULTI "ILE LITES"

Will give uniform illumination where you need it from the top to the bottom shelf with no lamp glare when you look down the aisle.

Reflector is porcelain enameled — the best for lifetime cleaning.

Mounting flexibility thru pendent — box cover — angle or feed thru sockets. Pull chain sockets also available for all types.

MULTI ELECTRIC MFG. Inc.
SEND FOR CATALOG
4237 W. LAKE ST.
CHICAGO 24, ILL.

SAFETY FIRST
and savings, too!

with INSUL-8-BAR®
SYSTEMS

Mobile Safety Electrification for Cranes, Monorails, All Moving Machinery.

These are the only enclosed conductor systems that meet *all* requirements of mobile safety electrification. Standard catalog parts eliminate the need for special engineering. Installation is fast, maintenance easy. Investigate today!

CLIP COUPON FOR CATALOG
INSUL8CORP
INSUL-8-CORP.
Dept. A, 1369 Industrial Rd., San Carlos, Calif.
Rush catalog re Insul-8-Bar mobile electrification.
NAME_____
COMPANY_____
ADDRESS_____
_____

J. A. Wilson Lighting and Display Inc.: J. A. Jobert & Associates, Lexington, representatives in Kentucky.

Auth Electric Co., Inc.: Petrie Moffat, representative for Northern Ohio.

Okonite Company: Robert B. Zane, manager, utilities and industrials, Chicago office.

Garcy Lighting: Hal Beard, agent with headquarters in Memphis, Tenn.

Westinghouse Electric Corp.: Donald M. Canfield, Cincinnati, Ohio, district sales manager, lamp division.

WEST CENTRAL

Auth Electric Co., Inc., Midwest Equipment Co. of Iowa, representative for Iowa; Walter Zimmerman, representative for Kansas and Oklahoma; Hawkins Electric Sales Co., representative for Missouri and southern Illinois.

J. A. Wilson Lighting and Display Inc.: W. D. Anderson Sales Co., representatives in North and South Dakota and Minnesota.

Markel Electric Products, Inc.: Schooler-Gorman Co., Kansas City, Mo., sales representative for Kansas and Missouri.

Prescolite Mfg. Co.: Zeb Chaney, El Dorado, Arkansas, southern sales manager covering Arkansas, Missouri, Texas, Kansas, Illinois, New Mexico, Louisiana, Mississippi, Tennessee and Georgia.

WEST

Spang-Howarduct Div., National Supply Co.: Arthur E. Bacon, Denver, agent in Colorado and eastern Wyoming; David M. Merrill, Farmington, Utah, agent in Utah, southeast Idaho, and Grand Junction, Colo.

Auth Electric Co.: Acme Corp., representative for north and south California; Peter Bach, representative for Oregon and Washington; David M. Merrill, representative for Utah; Ra-Tone Electronic Sales Co., representative for Arizona.

Zinsco Electrical Products: James Land, Jr., sales manager of Northern California Division, headquarters in Oakland.

Brown Boveri Corp.: Allen C. Conger, Northwest Regional manager, new office in Portland, Ore.

Edwards Company: Eugene C. Nicholson, district manager for Southern California.

J. A. Wilson Lighting and Display Inc.: Alan Humphrey Sales Co., Fresno, representative in Northern California.

MINERALLAC
BEAM
CLAMPS
FOR
MOUNTING
HANGERS
ON I-BEAMS

Mounts Minerallac hangers No. 0 to No. 6 on I-Beams safely without necessity of drilling holes. Made of heavy gauge zinc plated steel with deep drawn ribs to give needed strength, these durable, light weight beam clamps have ¼-20 tapped holes—will fit beam flanges up to ½ inch thick. Furnished with case-hardened set screw. Low cost.

Order From Your Electrical Wholesaler
SEND FOR LITERATURE
MINERALLAC ELECTRIC COMPANY
25 North Peoria St. Chicago 7, Ill.
MINERALLAC

NEW SUBSCRIPTION ORDERFORM
ELECTRICAL CONSTRUCTION & MAINTENANCE
330 West 42nd Street
New York 36, N. Y.

Please enter my personal subscription to start as soon as possible:
☐ $3.00 enclosed for one year*
☐ Send invoice

Please Print

Name .....
Title or Position .....
Address—Home ☐
Company ☐
City ..... Zone.....
State .....
Company Name .....
.....
Nature of Company's Business .....

I am in charge of elec. work—Yes ☐ No ☐
Operate a motor repair shop—Yes ☐ No ☐

**Above rates good only in U. S. Please write for rates in other countries.*

ELECTRICAL CONSTRUCTION COST MANUAL

Just Published! Shows you how to make estimates of electrical construction work, developed through standard assemblies, unit costs of total material and labor units, and the addition of job factors, overhead, and profit. Step-by-step procedures for take-off, pricing, and summarizing the estimate. Useful graphs, charts, tables, drawings, etc. **By R. E. Johnson, President, Sturgeon Electric Co. 431 pp., 6 x 9, illus., $10.00.**

STANDARD HANDBOOK for ELECTRICAL ENGINEERS

Thousands of facts and figures, systems and measurements, methods and materials from all fields of electrical engineering. Covers everything from electric and magnetic circuits, regulators and reactors, and prime movers—to illumination, power system electrical equipment, and electronics and electron tubes. New information on transistor-nuclear power, dielectrics for capacitors, synthetic resins and plastics, automation, telemetering, etc. **Prepared by a Staff of Specialists; Editor-in-Chief: A. Knowlton, Consulting Ed., *Electrical World*. 9th Edition, 2230 pp., 6 x 9, profusely illus., $19.50.**

JUST OUT

BUILDING CONSTRUCTION HANDBOOK

Just Published! Here's the handbook you need to see you through any building project. Covers key information on stress analysis, structural design, properties of building materials, construction practices, control of internal environment, building services, surveying, specifications, construction management, insurance, and bonds. All important modern developments given in ready-to-work form! **Prepared by a Staff of Specialists; Editor-in-Chief: F. S. Merritt, Senior Ed., *Engineering News-Record*.** 851 pp., 6 x 9, 428 illus., **$15.00**

WIRING MANUAL for HOME and FARM

Just Published! Enables you to plan the "small distribution system" needed in the typical modern home or farm electrical installation from beginning to end! Methods for determining loads, service entrance feeder size, number and size of branch circuits, number and type of outlets, etc—a new three-degree approach for simplifying the whole job of planning—quick reference tables and other working helps—sample contract specifications—and much more are given in this handy manual. **By A. C. Bredahl, Westinghouse Electric Corp. 221 pp., 5⅝ x 8, 101 illus., $4.95.**

EXAMINE THESE BOOKS FREE

McGraw-Hill Book Co., Dept. EC-4
327 W. 41st St., New York 36, N. Y.

Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus few cents for delivery costs, and return unwanted book(s) postpaid. (We pay delivery costs if you remit with this coupon—same return privilege.)

- ☐ Johnson—Elec. Const., Cost Man., $10.00
- ☐ Knowlton—Stand. Hdbk. for Elec. Engrs., $19.50
- ☐ Merritt—Bldg. Const. Hdbk., $15.00
- ☐ Bredahl—Wiring Manual for Home & Farm, $4.95

(PRINT)
Name .....
Address .....
City ..... Zone.... State.....
Company .....
Position .....
For price and terms outside U.S. write McGraw-Hill Int'l., N.Y.C. EC-4

NEW LAMP AND LUMINAIRE DESIGN

[FROM PAGE 98]

noted at the beginning of this discussion.

Triangular Pylons

Each 3-legged tower has a separate reinforced-concrete 10½-ft-sq vault set between its legs; these towers containing the remote ballasts for luminaires in addition to necessary disconnect switches. Wiring between vaults and luminaires is via rigid conduit, with luminaires properly phased out to minimize strobe effects, and with switching arrangements to permit half of the luminaires to be switched off when desired.

Depending upon location of towers and levels of illumination desired for the related adjacent areas, the number of luminaires mounted atop pylons vary from 12 to 4 (12 units being placed atop 9 towers; 10 atop 6; 8 on 6; 6 on 17 and 4 on 5). And, as a general rule, the six upper mounting positions on each pylon were used first, in order to obtain maximum height, minimize glare and promote easier maintenance from platforms.

In addition to supporting only these 1500-watt L-101 floodlight units, however, pylons located on the mall also support narrower-beam color-improved 400-watt mercury-vapor floodlight units; these subsidiary lights being mounted just below intersection points of tower legs (about 37 ft above the ground) in order to highlight the water in the nine reflecting pools, and to dramatize the attractive arrangement of flowers, shrubs and trees that add beauty to this distinguished terminal area.

For maintenance work, men are lifted to the sky-high platforms by means of jack-knifing hydraulic boom trucks although (for a brief moment along the earlier design route) the use of helicopters for this chore was fleetingly considered.

LIVE BETTER ELECTRICALLY

WHERE TO BUY

Rotometers - Plan Measures
•Tally Counters • Voltmeters • Megohmeters
R. A. KOENEMAN COMPANY
1409 Delmar Blvd. International Trade Mart
St. Louis, Mo. New Orleans, La.
MAIL ORDERS PROMPTLY FILLED

SEARCHLIGHT SECTION
(Classified Advertising)
EMPLOYMENT • BUSINESS
EQUIPMENT — USED OR RESALE
OPPORTUNITIES

EMPLOYMENT SERVICE

Foreign Employment opportunities with American companies overseas. All fields, high salaries, transportation paid. Write World Employment Information, Dept. 4, Box 3831, Los Angeles 54, California.

SALESMEN—SIDELINE
To call on dealers. Sell special wires, special extension cords, heating elements, parts for small appliances and lamps, etc. No inventory, liberal commission. Sell anywhere in U. S. Handle with your other lines. Write:
JANDORF ELECTRIC MFG. CO.
3600 Woodland Ave., Baltimore 15, Md.

ENGINEERS
Sr. Switchboard & Switchgear Design Estimating
Mechanical (Elec. Components Design)
Permanent West Coast Openings.
No personnel reductions since 1945.
Employment & Personal History to:
P-7643, Electrical Construction & Maintenance
1125 W. 6th St., Los Angeles 17, Calif.

Make More Money on Your Contracts!
Sell us your usable and left over NEW lengths of cable on your contracts. When your job is finished, don't bring this wire and cable back to your warehouse to lay there indefinitely—sell it to us.
PIERCE CABLE COMPANY
2919 N. Paulina Street, Chicago 13, Illinois

FOR SALE

1—Westinghouse DE-ION Grid Oil Circuit Breaker, Type GO-I-A, 34500 volts rating—Serial S.O. 1-3Y1526, 600 amps. Mfg. date 1946—60 cycle instrument book 33-746 and 5567—impulse withstand 200 KV, 32 gal. of oil per tank—total weight without oil 3450 lbs.—weight of oil and tank, 385 lbs.

3—General Electric single phase transformers—Type HS, 60 cycle, 33000V PRI 485V—sec. with 5-2½ taps, 5.2% impedance at 75°C, 400 KVA, 55°C rise, subtractive polarity, serial Nos. 7527-469, 7527470, 7527471.

FS-7523 Electrical Construction & Maintenance Class. Adv. Div., P.O. Box 12, N. Y. 36, N. Y.

Wire and Cable When You Want It!
From Chicago you can get immediate delivery on all types of Electrical Cable. Order today; we ship the same day. Let us supply your wire requirements.
UNIVERSAL WIRE & CABLE COMPANY
2919 N. Paulina Street Chicago 13, Ill.

Advertising In This Issue

Abolite Ltg. Div., the Jones Metal Prod. Co. 20
• Accurate Mfg. Co. 6
Acme Steel Co. 26
• Adalet Mfg. Co., The 289
• Advance Transformer Co. 2
Allen-Bradley Co. 33, 34
Allis-Chalmers Mfg. Co. 17, 21, 202
• All-Steel Equipment Inc. 52
Aluminum Co. of America 100, 101, 246
• American Blower Corp. 24
• American Brass Co., The American Metal Hose Branch 102
American Mfg. Co., Inc. 103
AMP Inc. 28, 29
Amprobe a Div. of Pyramid Instrument Corp. 231
Anaconda Wire & Cable Co. 106
Appleton Electric Co. 105
• Arrow Conduit & Fittings Corp. 282
• Arrow-Hart & Hegeman Electric Co., The 232, 233

Baker-Roos Inc. 244
Barth Corp., The 269
Beaver Pipe Tools, Inc. 104
Benjamin Electric Mfg. Co. 107
Benjamin Reel Products, Inc. 108
Bernz Co., Inc., Otto 111
Biddle Co., James G. 273
Black & Decker Mfg. Co. 189, 278
Blackhawk Industries 287
• Blackhawk Mfg. Co. 109
• Borthig Co., Inc., George 277
Brady Co., W. H. 112
Bryant Electric Co., The 113
BullDog Electric Products Co. 110, 237
Burndy Corp. 117
Bussmann Mfg. Co. 114, 115

Carol Cable Co., Div. of the Crescent Co., Inc. 31
Certified Ballast Mfgrs. 48
• Champion DeArment Tool Co. 220
Chase & Sons Inc. 191
Circle Wire & Cable a Subsidiary of Cerro de Pasco Corp. 51
Coffing Hoist Div., Duff-Norton Co. 120
Conduit Nipple Mfg. Co. 286
• Cope T. J., Div., Rome Cable Corp. 270
Cordley & Hayes 116
• Crouse-Hinds Co. ..Fourth Cover, 121
• Curtis Lighting, Inc. 122
Cutler-Hammer, Inc. 11

Day-Brite Ltg. Inc. 118, 119
Diamond Expansion Bolt Co., Inc. 123
Diamond Wire & Cable Co. 15
Dodge Corp., F. W. 32
Dow Corning Corp. 251

Eagle Electric Mfg. Co., Inc. 279
• Economy Fuse & Mfg. Co. 125
• Edwards Co. 126, 127
Efficiency Elec. & Mfg. Co. 124
Electrical Construction & Maintenance 290
Electrical Engineers Equipment, Co. 128
Electromode Div., Commercial Controls Corp. 262
Emerson-Pryne Co. 54
Erico Products, Inc. 211

Fasco Industries, Inc. 236
Federal Pacific Electric Co. 18, 19
• Federal Sign & Signal Corp. 129
• Feedrail Corp. 131
Fluorescent Fixtures of California. 130
• Fullman Mfg. Co. 206
Furnas Electric Co. 230

G & W Electric Specialty Co. 133
• Garden City Plating & Mfg. Co. .. 132
• General Cable Corp. 135
• General Electric Co.
• Apparatus Sales Div. 36, 37, 38, 39, 40, 41, 42, 43, 45
Lamp Div. 44
• Wiring Device Dept. 221
Globe Co., The 134
Goodrich Chemical Co., B. F. 195
• Graybar Electric Co., Inc. 56, 99, 182, 186
• Greenlee Tool Co. 136
• Guth Co., The Edwin F. Second Cover, 16

Heinemann Electric Co. 268
• Helwig Co. 288
• Henderson-Hazel Corp. 280
• Hevi-Duty Electric Co. 278
Hill Transformer Co., Inc. 272
• Hope Electrical Products Co., Inc. 137
• Hose-McCann Telephone Co., Inc. 288
• Hubbell, Inc., Harvey 143, 218

• Ideal Industries, Inc. 139, 284
Ilg Electric Ventilating Co. 147
Insul-S-Corp. 290
• International Register Co. 280
I-T-E Circuit Breaker Co. 138
Small Air Circuit Breaker Div. 222, 223
• Switchgear Div. 196, 197

• Jefferson Electric Co. 140
• Johns-Manville 266
Jones Metal Products Co., The 20

• Kaiser Aluminum & Chemical Sales, Inc. 142
Klein & Sons, Mathias 286
Knopp Inc. 190
Koeneman Co., R. A. 291

• Leviton Mfg. Co. 227
• Lidseen of North Carolina Inc. 145, 288
Lighting Products, Inc. 201
Lightolier, Inc. 245
Litecontrol Corp. 144
Louisville Ladder Co. 284

Machlett Laboratories, Inc. 148
Massey-Ferguson Industrial Div. Massey-Harris-Ferguson, Inc. ... 49
McGill Mfg. Co., Inc. 240
McGraw-Hill Book Co. 291
McPhilben Ltg. Co. 282
Mercoid Corp., The 146
• Minerallac Elect. Co. 290
Minnesota Mining & Mfg. Co. 27
Minneapolis-Honeywell 254, 255
Mitchell Lighting Co. 192
Moe Light Inc. 207
• Multi Electric Mfg. Inc. 290

National Carbon Co. 147
National Electric Products Corp. 12, 13, 149, 188, 257
• National Price Service 280
Nelson Electric Mfg. Co. 285
Nye Tool Co. 151

• O. Z. Electrical Mfg. Co., Inc. 154
• Okonite Co., The 150, 234, 235
Orangeburg Mfg. Co., Inc. 152
Oster Mfg. Co., The 210

Paranite Wire & Cable Div., Essex Wire Corp. 263
Pass & Seymour, Inc. 153
Pennsylvania Drilling Co. 274
Permacel-Lepage's Inc. 155
Pierce Renewable Fuses, Inc. 274
Pittsburgh Reflector Co. 158
• PLM Products, Inc. 200
Plymouth Rubber Co., Inc. 53
Pyle-National Co., The 156, 157

Quadrangle Mfg. Co. 265
Quaker Rubber Div., H. K. Porter Company, Inc. 264

• Rawlplug Co., Inc., The 159
Ray-O-Vac Co. 163
Reading Body Works, Inc. 276
Remcon, A Div. of Pyramid Instrument Corp. 208, 209
• Remington Arms Co., Inc. 253
Republic Steel Corp. 160, 161
Revere Elect. Mfg. Co. 162
Ridge Tool Co., The 219
Rockbestos Products Corp. 35
Rome Cable Corp. 46
Royal Electric Corp. 283
• Russell & Stoll Co., Inc. 287

• S & C Electric Co. 25
Salisbury & Co., W. H. 165
Sherman Mfg. Co., H. B. 289
• Simplex Wire & Cable Co. 164
Slater Electric & Mfg. Co., Inc. 225
Smitheraft Ltg. 167
• Sola Electric Co. 193
• Sorgel Electric Co. 238
Spang-Chalfant (Div. of the National Supply Co.) 8, 168
• Sperti Faraday, Inc. 169
Square D Co. ..... Third Cover, 1, 166, 281
Stampings, Inc. 194
• Standard Transformer Co. 170
• Steber Mfg. Co. 171
Steel City Electric Co. 160, 161
Steel & Tubes Div. 47
Sunbeam Ltg. Co. 10
Sylvania Electric Products Inc. 242, 243

Tal Bending Equip., Inc. 276
• Thiel Tool & Eng. Co., Inc. 286
• Thomas & Betts Co., The 173
Thor Power Tool Co. 172
Toledo Pipe Threading Machine Co., The 175
Tomic Sales & Engineering Co. 174
Tork Time Controls, Inc. 176
• Triangle Conduit & Cable Co., Inc. 177

• U-C Lite Mfg. Co. 284
Uptegraff Mfg. Co., R. E. 22, 23
U. S. Expansion Bolt Co. 226
Utica Drop Forge & Tool Div. of Kelsey-Hayes Co. 178

• Velocity Power Tool Co. 30
Virden Co., John C. 50

• Wagner Electric Corp. 198, 271
Wagner Malleable Products Co. 181
Wakefield Co., The 179
• Western Insulated Wire Co. 4
• Westinghouse Electric Corp.
Lamp Div. 14
Lighting Div. 258, 259
• Pittsburgh 213, 214, 215, 216, 228, 229, 248, 249
Weston Instruments Div. of Daystrom, Inc. 184
• Wheel Trueing Co. 180
Wheeler Reflector Co. 183
Where To Buy 291
Whitney Blake Co. 275

• Youngstown Sheet & Tube Co., The 185

■

CLASSIFIED ADVERTISING

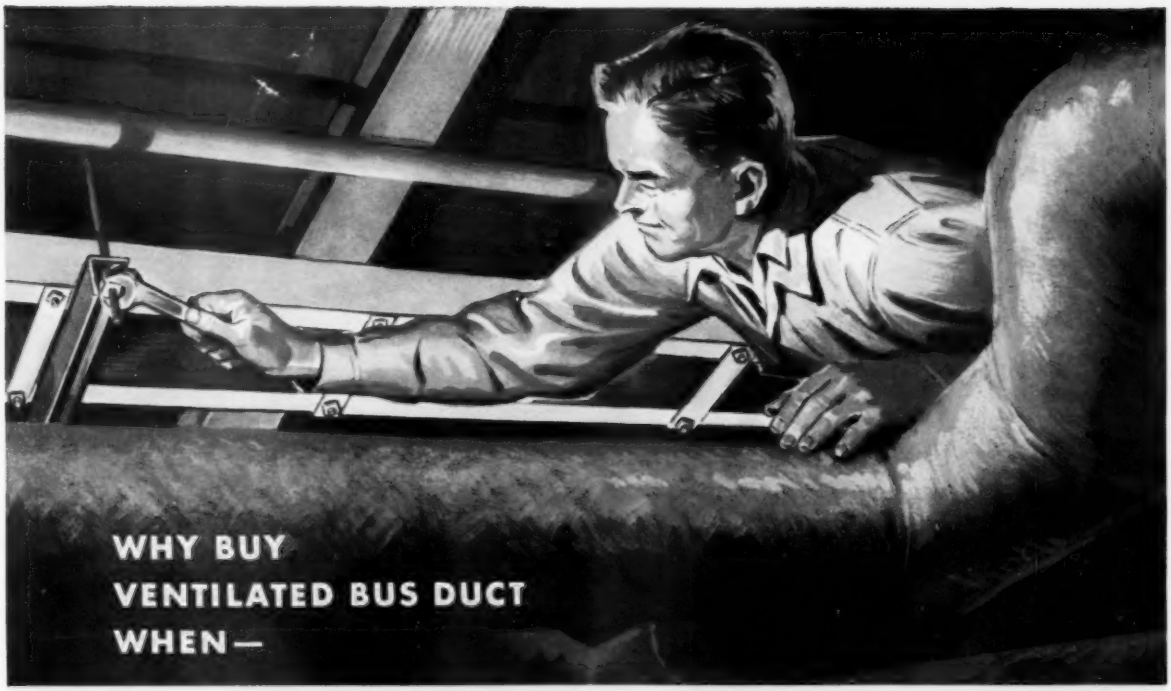
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES ... 291

EQUIPMENT
(USED or Surplus New)
For Sale 291

WANTED
Equipment 291

• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE



Square D TOTALLY ENCLOSED Duct*

takes less space—*and costs no more*

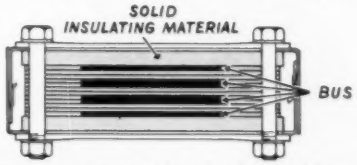
*(low impedance)

Ventilated bus duct is bulky and awkward. It's difficult—sometimes impossible—to install it in restricted areas. The layers of insulation around the bus bars and the necessary air spaces contribute to large, inconvenient size.

Square D totally enclosed feed-in duct solves the space problem. Solid sheets of insulation permit mounting bus bars only ¼" apart. This solid insulating material is also an effective heat conductor, thus eliminating the need for air spaces. The result—Square D low-impedance duct is as much as 50% smaller than ordinary duct. It can be used where no other duct fits. It makes expansion of existing electrical systems easier, new construction planning simpler. Best of all, Square D low-impedance bus duct is totally enclosed. Having no ventilation holes, it's safe from physical damage and dust accumulation. Needing no ventilation, it can be mounted in any position without de-rating.

Doesn't it make sense, when buying feed-in duct, to specify a product that will meet all your requirements? Square D totally enclosed low-impedance duct costs no more—why settle for less?

Here's Why Square D's EXCLUSIVE Design makes ventilation unnecessary



The entire space within the duct and between the bus bars is filled with a solid insulating material which conducts the heat to the surface. There are no dead air spaces inside the duct. Square D totally enclosed low-impedance duct is listed with Underwriters' Laboratories and meets U/L requirements for temperature rise in any mounting position.

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT . . . NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

New CROUSE-HINDS EXPLOSION-PROOF MERCURY VAPOR LIGHTING FIXTURES

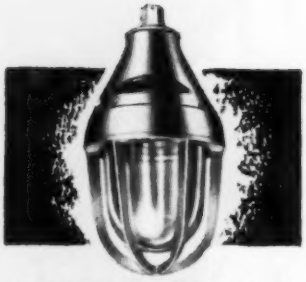
For dependable security at low operating cost in hazardous locations . . .

- *where long burning hours without interruption are involved, month in, month out*
- *where labor cost or trouble of relamping is an important factor*
- *where maximum lighting output calls for maximum economy in power consumption*

The longer life of mercury vapor lamps is well established: 7000 hours, *vs.* 1000 hours for incandescents. Light output is 2.5 times greater; 55 lumens/watt, *vs.* 22 lumens/watt for incandescents.

The new EV's place these economies within easy reach. As with all Crouse-Hinds explosion-proof devices, EV's are heavily constructed to withstand the pressure of internal explosions without rupturing. Gas-tightness is *not* a requirement for their safe performance. Flame-tight joints prevent the escape of flames to flammable atmospheres.

- *For full information, call your Crouse-Hinds distributor, or write for catalog sheet.*



TYPE EVA Explosion-Proof Lighting Fixture

Available with or without guard, or reflector (dome, deep bowl, shallow bowl, angle, or high bay)

250 Watt— National Electrical Code: Class I, Groups C & D

400 Watt— Class I, Group D

CROUSE HINDS

MAIN OFFICE AND FACTORY: SYRACUSE, NEW YORK

Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

● CONDULET® ELECTRICAL EQUIPMENT (Explosion-Proof and Conventional) ● FLOODLIGHTING ● TRAFFIC CONTROL SYSTEMS ● AIRPORT LIGHTING and WEATHER MEASURING EQUIPMENT

These products are sold exclusively through electrical distributors. For application engineering help, contact one of the following offices: Baton Rouge Birmingham Boston Buffalo Chicago Cincinnati Cleveland Corpus Christi Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee New Orleans New York Omaha Philadelphia Pittsburgh Portland, Ore. Salt Lake City St. Louis St. Paul San Francisco Seattle Tulsa Washington **Resident Representatives:** Albany Atlanta Baltimore Charlotte Chattanooga Jacksonville Reading, Pa. Richmond, Va. Shreveport